C D I
Geotechnical Services Group

SITE ASSESSMENTS · FOUNDATION ENGINEERING · CONSTRUCTION MONITORING

Project No. 09-401-01-00
April 12, 2010

Khalda Development
22861 Tindya
Mission Viejo, CA 92692

Attention: Mr. Robert Love

Subject: Preliminary Geologic and Geotechnical Evaluation
Tentative Tract 17325, 127 Acres, 7 Lot Residential
Community of Coto De Caza, CA

References: 1. ICG, Geotechnical Investigation, Proposed Hunt Lodge Facility, Coto De Caza, CA, Job No.: 01-6716-018-00-01, Log No.: 9-1164, dated July 17, 1989

We are pleased to submit our Preliminary Geotechnical Evaluation Report for the 127 acre, Tentative Tract 17325 residential development in Coto de Caza, California. This report presents the results of our office research, field investigation, and our opinions, conclusions and recommendations pertaining to the geotechnical aspects of the planned development.

It has been a pleasure to be of service to you on this project. Should you have any questions regarding the contents of this report, or require additional information, please do not hesitate to contact us.

We are looking forward to providing continued geotechnical services to you on this project.

Respectfully submitted,

CDI

Mark S. Smith, C.E.G. 1504
Principal Geologist

Enclosure: Preliminary Geotechnical Investigation Report (3 copies)

16325 Rainbow Ridge Road, Chino Hills, California 91709 · TEL (714) 496 - 7700 FAX (714) 529 - 1444

PRELIMINARY GEOTECHNICAL EVALUATION REPORT

PROPOSED RESIDENCIAL DEVELOPMENT
TENTATIVE TRACT 17325
COTO DE CAZA, CALIFORNIA

1.0 INTRODUCTION

(a) This report presents the results of our preliminary geotechnical evaluation performed for Tentative Tract 17325. The subject proposed development consists of a seven (7) lot residential development on 127 acres, located in unicorporated Coto de Caza, Orange County, California.

(b) The purpose of this preliminary geotechnical evaluation was to obtain geotechnical information on the surface and subsurface conditions and properties of foundation materials at the subject site. In addition, we have utilized the geotechnical information obtained to develop preliminary geotechnical recommendations and criteria for the design and construction of the proposed development. Geotechnical conclusions and preliminary recommendations related to site development including grading and foundations for the subject project are presented herein.

(c) We have utilized the Tentative Tract 17325 Lot Layout Configuration Study #4 Plan, prepared by CSL Engineering, Inc., 1 in.: 100 ft. scale, dated June 18, 2009, as a base map for the attached Geologic Map, Plate 1. Grading, foundation, structural, and architectural plans were unavailable as of the date of this report. We understand that the findings and recommendations of this report will be used in the development of such plans.

2.0 PROJECT DESCRIPTION

(a) The proposed lots are planned on the west facing and west descending, upper eastern slopes, adjacent to the eastern ridgeline of the north–south oriented Canada Gobernadora. Access to the proposed development area is by an easement located near the northeast corner of Tract15245.

(b) Based on the Lot Layout Configuration Study #4, the proposed project development at the subject property will consist of seven (7), custom home lots, ranging from two to nine acres. Each lot is planned with approximately ½ acre residential building pad areas. The plan also shows access driveways, associated streets, utilities, drainage control, and landscape improvements areas.

(c) The 7 proposed building pad elevations range from 716 to 786. No information is available at this time regarding proposed structure locations, architectural details, and design loads for the proposed residential structures. For the purpose of this geotechnical evaluation, it is assumed that the maximum column and wall load for the proposed structures will not exceed 30 kips and 3 kips per linear foot, respectively.

(d) Standard cut and fill grading technique will most likely be used to create cut and fill slopes, relatively level building pads, and access streets and driveways. Relatively shallow cuts and fills incorporating low height retaining walls are planned for the access roadway. An approximate 40 ft. daylight cut to grade is planned to prepare the building pad areas for lots 1 through 4. Relatively shallow cut and fill slopes in the order of 30 ft. are planned to prepare the pads on lots 5 through 7. The west facing cut and fill slopes will require slope stabilization mitigation.

3.0 AUTHORIZATION

This preliminary evaluation investigation was performed in accordance with our Proposal dated January 16, 2009.

3.1 Previous Investigations

(a) This site was previously investigated for utilization as a hunt lodge recreation area. Personnel of this firm participated in the previous investigation authorized by Coto de Caza Development Inc.. Pertinent published geologic reports utilized for this report are listed in Appendix A, References.

(b) Subsurface geologic information and on-site soil engineering criteria presented in the previous on-site geologic investigation report have been incorporated into this report. Approximate locations of the previous investigation's subsurface boring excavations are plotted the attached Geotechnical Map, Plate 1.

4.0 SITE DESCRIPTION

4.1 Location

(a) The 127 acre, Tentative Tract 17325 project site area is situated on the upper eastern ridgeline of Canada Gobernadora, in the unincorporated community of Coto de Caza, Orange County, California.

(b) The subject property consists of an undeveloped, irregular shaped parcel, which is bound on the east by the eastern Canada Gobernadora ridgeline, Tract 15245 on the west, and undeveloped open space property to the north and south. The subject property is presently unoccupied by any structures or improvements.

(c) The Lot Layout Configuration Study #4 Plan, dated June 18, 2009, prepared by CSL Engineering, indicates that the subject 7 lot development plan includes designated areas for building sites, access roadways, street improvements, open space, and drainage control.

4.2 Surface Conditions

(a) Topographic map coverage of the site and vicinity can be found on the United States Geological Survey (USGS) 7.5 minute, Santiago Peak Quadrangle, 1954 photo-revised in 1988. The elevation of the subject property ranges from approximately 900 feet to 645 feet above Mean Sea Level, (MSL).

(b) The subject property and immediately adjacent properties are in a natural undisturbed condition. Topographic relief across the site ranges from elevation 900 ft. in the northeast corner of the property, to 645 ft. elevation in the southwest corner of the property. The natural slopes generally descend towards the southwest from the eastern ridgeline and are mostly at a gradient of 3-H:1-V, with steeper gradients (approximately 2-H:1-V) along the upper eastern ridgeline.

(c) Surface drainage on the subject site consists of sheet-flow over the natural ground surface and natural drainage channels.

(d) Vegetation on the site is generally characterized by a dense growth of native grasses and low brush on the relatively flat and lower gradient slopes. Steeper slopes are covered with brush and low trees, and clusters of oak trees in the drainage courses and lower portions of the drainage channel slopes.

5.0 SUBSURFACE EXPLORATION

5.1 Field Exploration

(a) Subsurface conditions were explored and reported by Irvine Soils Engineering, Inc., the previous geotechnical consultants, Appendix A, Reference 1. Twenty bucket auger borings were excavated at the approximate locations shown on Geotechnical Map, Plate 1, attached. The borings were excavated to depths ranging from approximately 50 to 100 feet below the existing site grades. A geologist from this firm logged the borings during the drilling operations and obtained the bulk and relatively undisturbed soil samples for identification and the laboratory testing completed by the previous consultant, Irvine Soils Engineering.

(b) Descriptions of the field exploration program, Key to Logs and Logs of Borings B-1 through B-20 extrapolated from the previous report are attached, see Appendix B.

5.2. Laboratory Testing

(a) The previous consultants laboratory testing was performed on relatively undisturbed and bulk soil and bedrock samples considered representative of the subsurface conditions. Details of the laboratory testing program and test results have been extrapolated from the previous report, Reference 1, and are presented in Appendix C.

6.0 GEOLOGY AND SEISMICITY

6.1 Geologic Setting

(a) Regionally, the site is situated in the northern portion of the Peninsular Ranges Geomorphic Province of Southern California. Northwest-southeast trending structural blocks bound by a series of active, northwest-southeast trending, high-angle, right lateral, strike-slip faults, characterize the Peninsular Ranges Geomorphic Province.

(b) In respect to regional structure, the subject site is situated near the southeastern margin of the Central Block of the Los Angeles Basin. The Central Block is bound on the east by the active Elsinore Fault, on the north by the active Whittier segment of the North-Elsinore Fault, on the southwest by the active Newport-Inglewood Fault Zone, and on the southeast by the coalescence of the Santa Ana Mountains and the San Joaquin Hills.

(c) Locally, the site is underlain by low to moderate west to southwest dipping Eocene age sandstone bedrock strata of the Santiago Formation. Quaternary surficial units exposed on-site include: terrace deposits covering the crest of the ridgeline along the eastern property boundary and a thin veneer of colluvium on the slopes and high ground areas. Moderately thick deposits of alluvium and colluvium cover bedrock in the gentle sloping and low laying areas, and recent alluvium along the active drainage. A thin layer of organic rich topsoil covers most of the gentle sloping areas.

6.2 Structural Geology

(a) The Tertiary age bedrock strata underlying the subject site area can be generally characterized as broadly folded strata, situated on the eastern limb of a northwest trending syncline. Broad warping of the strata is evident, exhibiting only small variations in bedding attitudes across the site area. Bedding attitudes generally strikes northwest, and dip at low to moderate inclinations towards the west and southwest.

(b) In respect to local structure, the underlying sedimentary bedrock on-site can be described as monoclinally, westerly-dipping strata. The bedrock strata in the area, exhibits a fairly uniform dip component of approximately 15 degrees to the southwest. The low to moderate westerly dip bedrock strata and westerly descending slopes that exist along the eastern ridgeline has produced a dip-slope and out-of-slope dip condition. The out-of-slope dip condition and bedrock material type have produced several landslides.

6.3 Subsurface Conditions

(a) Subsurface Soil Profiles:

The profiles of the subsurface soil and bedrock materials encountered in the borings during the previous field investigation are described in detail on the Logs of Borings, Appendix B. The approximate locations of these borings are shown on Geotechnical Map, Plate 1. General descriptions of the materials encountered are presented in the follow sections.

(b) Alluvium/Colluvium, map symbol (Qal/Qcol):

Alluvium/colluvial deposits consisting predominantly of medium to dark brown, silty sand and clayey sand is present in the drainage courses that traverse the site and underlie the lower gradient portions of the site. The depth of this alluvium/colluvium was observed to be approximately 40 feet in Boring B-15, and 3 to 5 feet thick on the lower gradient areas.

(c) Bedrock, Santiago Formation, map symbol (Tsa):

The Tertiary Santiago Formation is poorly exposed in the area. The bedrock strata is generally concealed beneath a topsoil material similar to alluvium/colluvium. Where observed, the Santiago Formation bedrock material consist predominantly of light to medium dark, red to yellow brown and blue to green grey, slightly moist, very hard, partially indurated, fine to coarse-grained, poorly bedded to massive, clayey to silty sandstone and sandy siltstone.

(d) Terrace Deposit, map symbol (Qt):

Quaternary terrace deposits cover the crest of the ridge along the eastern side of the subject property. The terrace deposits are composed of yellowish brown to reddish brown, sandy gravel and cobble conglomerate, intercalated with clayey silty sand, clayey sandy silt, and sandy silty clay. The maximum thickness of the terrace deposit on site is estimated to be 45 feet. Displaced terrace deposits material has been incorporated into portions of the composite landslide deposit.

(e) Topsoil

The site is covered with a thin veneer of organic rich topsoil. The topsoil material generally consists of medium to dark brown sandy clayey silt to silty clay, with trace to some fine gravel to fine cobble.

(f) Landslide Deposit, map symbol (Qls):

The lateral limits of the landslide complex are shown on the attached Geotechnical Map, Plate 1. Portions of the landslide complex were observed in Borings B-1 through B-5, B-13, and B-16 through B-20, and consist mainly of siltstone and sandstone derived from the Santiago Formation. Minor occurrence of conglomeratic silty sand derived from the terrace deposit, and colluvium consisting of gravelly, clayey, silty sand. The bedrock materials observed within the landslide deposits, consist generally of large blocks of the bedrock strata, and appears poorly bedded to massive. The blocks of bedrock derived materials have numerous partially closed to closed fractures and shears. In most instances, the partially closed fractures and shears were in-filled.

(g) Groundwater Conditions

A static groundwater table was not encountered during the previous field investigation, and the groundwater condition is not expected to have changed since the previous investigation. The static groundwater table is anticipated to be in excess of 50 feet below the lowest natural grade elevation on site. Groundwater seepage from the shears and fractures was observed at depths of 30 to 60 feet below natural grade at the boring locations, in the bedrock and landslide materials. The conditions reported herein refer only to the observations made at the time of the previous investigation. Generally, groundwater conditions can be affected by seasonal fluctuations of rainfall and environmental changes such as irrigation or pumping. Therefore, deviations from our observations may occur.

6.4 Landslide Complex

(a) The landslide complex (Qls) shown on the Geotechnical Map, after Morton and Miller (1981), was confirmed and refined in detailed during the previous investigation. Individual failures within the landslide complex all moved generally block glide down dip in a westerly direction. The basal rupture surface was identified during the previous subsurface investigation at depths ranging from 25 to 72 feet below existing nature grade. Measurements taken on the rupture surface indicated that the orientation is parallel to sub-parallel to strike and dip of the regional structure.

(b) High angle conjugate joints and shears are present in the siltstone and sandstone landslide debris. Generally, the fractures, joints, and shears in the landslide deposit are closed. Minor occurrences of bedrock shears were observed below the basal rupture surface, and are most likely a result of intra-formational shearing related to folding or faulting.

6.5 Regional Seismicity

(a) The site is located in a seismically active area, as is all of Southern California. There are, however, no known active faults that transverse on or immediately adjacent to the site. According to the State of California Special Publication 42, Fault Rupture Hazard Zones in California, the subject site is not located within a zone affected by fault rupture. Based on the State of California Seismic Hazard Maps, Canãda Gobernadora Quadrangle, dated September 23, 2002, the subject site is not located within a zone that is prone to earthquake-induced liquefaction or within a zone identified as having risk from earthquake-induced landslides.

(b) The nearest known active fault is the San Joaquin Hills Blind Thrust Fault, located approximately 5.5 miles (8.7 km) southwest of the subject site. The San Joaquin Hills Blind Thrust Fault, has an assigned estimated peak earthquake magnitude (Mw) of 6.95, and a peak acceleration of 0.48g, that can be expected at the site. Other active faults in relative close proximity to the subject site include the Elsinore Fault Zone, located approximately 10 miles east of the site. The northwest-southeast trending Elsinore Fault Zone is located on the eastern side of the Santa Ana Mountains.

(c) We have evaluated the possible earthquake accelerations at the site and determined that for the intended use the most significant event is an earthquake magnitude (Mw) 6.95, on the San Joaquin Hills Blind Thrust Fault Zone. Strong shaking due to an anticipated maximum probable event on the closest segment of the fault could produce peak ground accelerations in excess of 0.48g, and the shaking may be expected to exceed 20 seconds in duration. Design parameters based on Chapter 16, Section 1613 of the 2007 Edition of the California Building Code (CBC), are presented in Section 7.5 of this report.

(d) Locally, two fault traces have been mapped in the subject site, Morton and Miller, (1981). The faults are shown on the attached geotechnical Map, Plate 1. These faults have been shown discontinuous to the north and south of the project site area, and are not considered active, however structural set-back should be considered.

6.6 Geologic Hazards

(a) Surface rupture usually occurs along lines of previous faulting. Since there is no evidence of active faulting on the subject site or immediately adjacent to the subject site, the possibility of lurching or shallow ground rupture is considered low in comparison to other areas of Southern California.

(b) The term "liquefaction" describes a phenomenon in which a saturated cohesionless soil loses strength and acquires a degree of cyclic mobility as a result of strong ground shaking during an earthquake. The factors known to influence liquefaction potential include soil type and depth, grain-size, relative density, groundwater level, degree of saturation, and both the intensity and duration of ground shaking. A static or confined groundwater table was not encountered in the borings drilled. Considering the generally medium dense condition of the alluvial/colluvial soils, absence of static groundwater table or confined groundwater, and presence of hard bedrock at shallow depths, it is our opinion that there is no potential for soil liquefaction at the subject site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 General

(a) Based on the results of this preliminary investigation, combined with engineering analysis and our experience and judgement, it is our opinion that, from the geotechnical and geologic standpoint, the site may be developed as planned, provided the site grading and foundation criteria discussed herein are incorporated in the project plans and specifications and implemented during construction.

(b) The geotechnical recommendations provided herein should be reviewed when final project concept, and grading and foundation plans are available.

7.2 Geotechnical Considerations

(a) The major geotechnical considerations affecting the planned development are:

- Presence of disturbed and dry near surface soils, landslide and slope instability mitigation, erosional gullies and natural drainage channels within the site.
- Non-uniform properties and depths of colluvium in the low-lying areas
- Cut and fill required to achieve planned building and site grades.

(b) It is our opinion that remedial grading consisting of over-excavation of the existing alluvium/colluvium and bedrock materials, and back-filling with the excavated materials as approved compacted fill, will be necessary in planned fill areas to reduce fill settlements and provide satisfactory performance of fill areas. Similar remedial grading will also be required in other improvement areas such as driveways and exterior concrete flat work.

(c) In improvement areas traversing bedrock cut–fill transition, over-excavation of bedrock to recommended depth and replacement with approved compacted fill will be necessary to reduce the potential for differential foundation movements.

(d) All planned westerly facing slopes, cut and fill should be constructed with slope stabilization grading techniques.

7.3 Earthwork

7.3.1 General Earthwork and Grading Specifications

All earthwork and grading operations should be performed in accordance with all applicable requirements of the Grading and Excavation Code, and the Grading Manual of the County of Orange, California and other governing jurisdictions, in addition to the recommendations presented herein.

7.3.2 Site Preparation

(a) Existing Improvements

Prior to grading operations, although no improvements are known to exist on site, any structures, utility, including asphalt paving, concrete flat-work and any buried obstructions or debris should be removed from areas of proposed construction. Structure removal should include foundations. Wood, concrete and asphalt fragments if encountered should be removed and disposed off-site.

After the removal of existing structures, utilities and buried obstructions, resulting excavation bottom extending below the zones of recommended rework as described below should be scarified minimum 6 inches depth, moisture-conditioned as required, and compacted to minimum 90 percent relative compaction, prior to placing new compacted fill.

(b) Surface Vegetation and Debris

The entire site should be stripped of existing vegetation, and any debris or deleterious materials. The depth of stripping will vary with the time of the year the work is done and must be observed by the Geotechnical Consultant. Removal of trees and shrubs should include root-balls and attendant root system.

Any soils contaminated with organic matter (such as root system or strippings mixed into the soils) should be disposed off-site or set aside in stockpiles for future use in landscape areas.

(c) Underground Utilities

As the site is an undeveloped parcel, no underground utilities are anticipated. However, if underground utilities are encountered during grading, they should be removed, and capped and plugged at the property limits according to applicable code requirements.

Any underground utilities to be abandoned within the zone of proposed construction should be cut-off a minimum of 5 feet from the area of future building. The ends of cut-off lines should be plugged a minimum of 5 feet with low-shrinkage concrete to prevent water migration to and from hollow lines. Capping of lines may also be required should the plug be subject to any line pressure.

As an alternate, deep hollow lines may be left in place, provided they are filled with concrete. No filled line should be permitted closer than 2 feet from the bottom of future footings. Local ordinances relative to abandonment of underground utilities, if more restrictive, shall supersede the above minimum requirements.

Any wells encountered should be capped in accordance with the County Health Department requirements. The strength of cap should be in accordance with the requirements of the controlling authority.

7.3.3 Temporary Excavation Slopes

(a) Based on the results of our exploration, it is our opinion that the site soils and bedrock can be excavated using conventional earth-moving equipment.

(b) Excavations in site soils should be temporarily shored or sloped in accordance with Cal-OSHA requirements. Temporary excavation slopes in site soils and bedrock, where utilized, should be no steeper than 1H:1V, to a maximum height of 10 feet. Flatter slopes or shoring may be necessary for temporary cuts deeper than 10 feet.

(c) Stockpiled materials and excavating/grading equipment should be kept at a minimum distance from the top of slope equal to the slope height.

(d) This office should review the soil conditions during excavations to verify the acceptability of temporary slopes. Final temporary excavation slope design will be dependent on actual soil conditions encountered, construction procedures and schedule.

7.3.4 Permanent Cut and Fill Slopes

(a) Based on the results All permanent excavation slopes in bedrock and fill slopes should be properly designed, constructed, and maintained to assure satisfactory performance under design loading and service conditions. Permanent bedrock excavation and fill slopes should be constructed at gradients no steeper than the maximum slope angles shown below:

Slope Condition	Maximum Slope Angle
Excavation slopes in bedrock	2H:1V
Fill slopes	2H:1V

(b) The above criteria may be used for preliminary project planning and design purposes. The final design of bedrock cut and fill slopes should be based on additional analysis after the site grading concepts are clearly defined.

7.3.5 Remedial Grading and Site Improvement Measures

(a) Remedial grading consisting of over-excavation of the near surface loose disturbed soils and colluvial materials, and replacement with properly compacted fill soils will be necessary to provide more uniform support for new fill placements, foundations, and slabs-on-grade, reduce structure settlements, and provide satisfactory performance of planned construction. Recommended depths of remedial grading in various areas are shown below:

Area / Location	Minimum Depth of Remedial Grading, (Feet)
Fill areas	5.0
Improvements in bedrock cut	1.0
Exterior concrete flat-work and walk-ways in fill areas	3.0
Improvements in bedrock cut-fill transition areas	3.0 (*)

(*) Applies to bedrock portion

(d) Although not observed in the exploratory borings, if undocumented fill soils are encountered below the zones of recommended over-excavation shown above, they should be removed full depth and replaced with approved compacted fill material.

(e) The Geotechnical Engineer or his representative should evaluate the suitability of all excavation bottoms by appropriate field observations and testing. The excavation bottoms in colluvium are considered acceptable for new fill placement if the sub-grade soils exhibit a relative compaction of at least 86 percent within the upper one foot, based on ASTM: D 1557.

(f) Prior to back-filling, the excavation bottom should be scarified to minimum 6 inches depth, thoroughly wetted, and compacted to minimum 90 percent relative compaction (ASTM: D1557).

(g) If new fill is to placed over sloping ground steeper than 5H:1V, the excavation bottom should be adequately benched prior to fill construction. In addition, structural fill key should be constructed at the toe of new fill slopes.

7.3.6 Backfill Criteria

(a) Excavated on-site materials may be used as fill material.

(b) Import fill material should be approved by the Geotechnical Consultant prior to use. The Geotechnical Consultant should be notified not less than 5 working days in advance of placing any import fill or base course material. Each proposed source of import material should be sampled, tested and approved by the Geotechnical Consultant prior to delivery of any import soils to the site.

(c) Import soils, if needed, should consist of predominantly granular soils exhibiting an Expansion Index of less than 20, and should be approved by the Geotechnical Consultant.

(d) All soils, both existing on-site and imported, to be used as fill, should be free of organic matter, debris, cobbles over 6 inches maximum dimension, and other deleterious matter.

(e) Fill soils should be placed in horizontal loose lifts, 6 inches maximum thickness, moisture-conditioned to near and within 3 percentage points wet of the optimum moisture content, and compacted to minimum 90 percent relative compaction (ASTM: D1557).

7.3.7 Utilities

(a) The on-site soils may be used for backfill of utility trenches from one foot above the top of pipe to the surface, provided the material is free of organic matter, rocks over 6 inches in maximum dimension, and other deleterious substances. The on-site clean granular soils and import granular soils are considered suitable for bedding or shading of utilities provided these soils exhibit a sand equivalent greater than 30. Any soft or unsuitable material encountered at the pipe invert level should be removed and replaced with properly compacted fill or adequate bedding material.

(b) Backfill of all interior and exterior utility trenches should be placed in thin lifts not exceeding 4 inches in loose thickness, moisture-conditioned as required, and mechanically compacted to achieve a relative compaction of not less than 90 percent (ASTM: D1557). Care should be taken during back-filling to prevent utility line damage.

(c) The walls of temporary construction trenches are expected to be stable when excavated nearly vertical, with only minor sloughing, provided the total excavation depth does not exceed 4 feet. Shoring of excavation walls or flattening of slopes will be required, if greater excavation depths are necessary.

(d) Utility trenches should not be located within the influence of foundations in order to prevent adverse effect on the bearing capacity of soils and settlement under foundations. As a guide, trenches parallel to foundations should be clear of a 45-degree plane extending outward and projected downward from the bottom outside edge of foundations.

(e) If utility lines are located within the zone of footings, the trench backfill should be compacted to minimum 95 percent relative compaction or slurry back-filled.

(f) All work associated with trenches, excavations and shoring must conform to the local regulatory requirements, State of California Division of Industrial Safety Codes, and Federal OSHA requirements.

7.4 Site Drainage

(a) Surface grades adjacent to buildings should be designed and constructed to direct and facilitate drainage away from structures to approved drainage facilities. Recommended minimum grade in unpaved soil areas around buildings and asphalt-paved areas is 2 percent, and in concrete paved areas is 1 percent. Accumulation of water around buildings and in pavements should be avoided. Concentrations of surface run-off should be collected and drained to suitable discharge outlets.

(b) Approved drainage patterns should be installed and maintained throughout the life of structures. The building and surface drainage facilities should not be altered without the prior review and approval of the Project Civil Engineer.

(c) All roof eaves should be guttered and include outlets directed to suitable discharge facilities.

(d) Irrigation activities at the site should be controlled to reduce over-watering. Planter areas adjacent to structures should be avoided. If utilized, they should include measures to contain irrigation water and prevent it from seeping into walls and under foundations and slabs-on-grade.

7.5 Seismic Design Considerations

(a) Based on geologic evaluation presented in Section 6.5, the effects of ground accelerations from nearby fault zones should be considered in the design of the proposed structures. The closest known active fault to the site is the San Joaquin Hills Blind Thrust Fault, located approximately 5.5 miles southwest of the subject site.

(b) The proposed development should be designed in accordance with seismic considerations contained in the 2007 Edition of the California Building Code (CBC), and County of Orange requirements.

(c) The following parameters based on Chapter 16, Section 1613 of the 2007 (CBC) may be considered for design:

1. Site Class : B
2. Site Coefficients
   - F_a : 1.0
   - F_v : 1.0
3. Mapped spectral accelerations
   - S_s (for short periods) : 1.275
   - S_1 (for 1-second period) : 0.471
4. Site adjusted spectral accelerations
   - S_{MS} (for short periods) : 1.275
   - S_{M1} (for 1-second period) : 0.471
5. Design spectral accelerations
   - S_{DS} (for short periods) : 0.850
   - S_{D1} (for 1-second period) : 0.314

(d) As discussed in Section 6.5, it our opinion that there are no geologic hazards which would impact the planned development. It should be realized that the purpose of the seismic design, utilizing the above parameters, is to safeguard against major structural failures and loss of life, but not to prevent damage altogether. Even if the structural engineer provides designs in accordance with the applicable codes for seismic design, the possibility of damage cannot be ruled out if moderate to strong shaking occurs as a result of a large earthquake. This is the case for essentially all structures in Southern California.

7.6 Preliminary Foundation Design Considerations

7.6.1 Foundation Type

The proposed structures may be supported on conventional spread and continuous footings bearing on undisturbed and competent bedrock or approved compacted fill.

7.6.2 Allowable Soil Bearing Capacity

(a) All footings should be founded at a minimum depth of 2 feet below the lowest adjacent final soil grade. The spread and continuous footings supported on undisturbed and competent bedrock or approved compacted fill at the minimum recommended depths may be designed for a maximum allowable net bearing pressure of 2,000 psf. (dead and live load). This value may be increased by one-third for transient wind or seismic forces.

(b) The recommended allowable bearing pressure will apply to square footings maximum 4 feet wide and continuous footings maximum 1.5 feet wide.

(c) Recommended minimum footing width is one foot.

7.6.3 Foundation Settlements

The total settlements of spread and continuous footings designed and constructed in accordance with the above criteria, and supporting loads not exceeding 30 kips for columns and 3 kips per linear foot for walls, are not expected to exceed one inch. The differential settlements between similarly loaded column footings and continuous footings over a distance of approximately 30 feet are anticipated to be less than 0.75 inch.

The foundation settlements should be re-evaluated if the design loads exceed the assumed values by more than 10 percent.

7.6.4 Lateral Resistance

(a) Lateral loads can be resisted by passive earth pressure and by friction acting on structural elements in permanent contact with sub-grade soils.

(b) Lateral resistance on the sides of footings may be computed using a passive earth pressure of 250 psf per foot depth, subject to a maximum of 2,500 psf. An ultimate friction coefficient of 0.35 may be assumed with dead load forces on slab-on-grade or footings in permanent contact with sub-grade soils.

7.6.5 Floor Slab Design

(a) The existing bedrock will be excavated some 20 + feet to create a level pad for the planned residence construction. Therefore, the building floor slab will be bearing on excavated bedrock cut. In order to achieve a uniform support for the floor slab, the excavated bedrock surface should be scarified minimum one foot and re-compacted to at least 90 percent relative compaction, in accordance with the recommendations in Section 7.3.5

(b) The bedrock materials generally consist of silty sands and clayey sands with low plasticity. Based on the test results presented in Appendix C, it is our opinion that soil expansion would not be a significant factor in design. The expansion index of the sub-grade soils should be verified during grading.

(c) Slab sub-grade soils should be moisture-conditioned 24 to 48 hours prior to the time the concrete is placed.

(d) Interior floor slab should be properly designed by the Project Structural Engineer for the construction and service load conditions.

(e) The Project Structural Engineer should establish the structural details of slab such as thickness, concrete strength, reinforcement, joint spacing, etc.

(f) To reduce the potential for moisture migration up through the slab and possible damage to floor coverings, a moisture barrier below the floor slab is recommended. This should consist of minimum 10-mil thick waterproof membrane, placed in the middle of a 4 - inch thick clean sand layer, placed above the prepared slab sub-grade. The membrane should be properly overlapped and sealed at joints and utility risers following manufacturer's specifications.

7.6.6 Soil Corrosion Analysis

Laboratory testing on representative samples of bedrock materials indicated a sulfate content ranging from 0.0066 to 0.0074 percent. Soils with sulfate concentrations less than 1000 ppm (0.10%) are generally reported to have a negligible corrosive effect on concrete as defined in Table 19-A-4 of the UBC (1997 edition). It is our opinion that Type II Portland cement with a maximum water-cement ratio of 0.50 may be used for concrete in contact with site soils, subject to the approval of the Project Structural Engineer.

7.7 Retaining Wall Design Criteria

7.7.1 Lateral Earth Pressures

(a) Retaining walls should be adequately designed to resist the lateral soil pressures and the anticipated construction loadings and service conditions. The earth pressure acting on retaining walls depends primarily on allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure.

(b) The following earth pressures are recommended for vertical walls with no hydrostatic pressure, no surcharge, and level backfill:

Wall Type	Lateral Earth Pressure (Equivalent Fluid Pressure, pcf)
Cantilever (Free to deflect)	40
Rigid (Restrained)	60

These lateral earth pressures are applicable to compacted backfill placed between the wall stem and an imaginary plane rising at 45 degrees from below the edge (heel) of the wall footings. The surcharge effects of any adjacent loading conditions (eg. structures, traffic loads, floor loads, etc.) should be included in retaining wall design, as appropriate.

(c) Depending on whether the wall is free to deflect or restrained, 33 or 50 percent, respectively of maximum surcharge load located within a distance equal to the height of wall should be used in design.

7.7.2 Retaining Wall Footings

(a) Retaining wall footings should be supported on undisturbed and competent bedrock or approved compacted fill at a minimum depth of 24 inches below the lowest adjacent final soil grade. The footings may be designed using a maximum allowable net bearing pressure of 2000 psf. (dead and live load). This value may be increased by one-third for transient wind or seismic forces. Recommended minimum footing width is one foot.

(b) Backfill adjacent to footings should be compacted to minimum 90 percent relative compaction in accordance with the recommendations in Section 7.3 and it should extend to a lateral distance of at least 3 feet beyond footing edges.

(c) In bedrock cut-fill transition areas, the bedrock should be over-excavated minimum 3 feet and back-filled with approved compacted fill, in order to reduce the potential for differential foundation settlements due to non-uniform foundation support conditions (see Section 7.3.5). Alternately, the wall footing may be locally deepened with physical separation (cold joint) between the wall segments bearing on bedrock and fill.

7.7.3 Drainage and Waterproofing

(a) Sub-drains should be provided in the wall backfill or weep holes/slits and they should be installed at the base of retaining walls, where feasible. As a minimum, sub-drains should consist of 4-inch diameter, perforated Schedule 40 PVC pipe or equivalent, embedded in approximately 3 cubic feet per lineal foot of permeable material meeting the State of California Standard Specification Section 68-1.025, Class 1, Type A, or equivalent. This permeable material should be enveloped in Supac 5NP geofabric filter fabric or equivalent. The pipe should be located approximately 6 inches above the footing, and the pipe and trench bottom should be sloped at a minimum gradient of 1 percent to a suitable discharge outlet.

(b) All interior retaining walls should be water–proofed in accordance with the recommendations of the Project Civil Engineer.

7.8 Exterior Flat-work

Exterior concrete flat-work (patio slab and walkways) should be minimum of 4 inches thick, and reinforced with No. 3 bars at 24 inch on centers, both directions, placed midheight within the slab.

7.9 Driveway

(a) The concrete pavement section for driveways should be minimum 5 inches thick, and should be reinforced with minimum No. 3 bars at 18 inches centers, in both directions, and placed at mid-height of slab.

(b) It is recommended that a minimum 4-inch thick layer of granular material (sand or gravel) underlie the concrete pavement. This base layer should be compacted and should exhibit a firm and unyielding condition prior to concrete placement.

(c) The entrance to the garage should be provided with a grade beam at least 18 inches deep, rigidly tied to the peripheral footings.

8.0 PLAN REVIEW, OBSERVATIONS, AND TESTING

(a) The final grading plans should be provided to our office for review in order to evaluate the acceptability of the recommendations presented herein, and provide additional recommendations, as appropriate.

(b) All construction activities during grading and foundation excavations should be continuously monitored and observed by the Geotechnical Engineer.

(c) All grading operations and foundation excavations should be observed and tested as required, by a representative of the Geotechnical Engineer to verify conformance with the intent of the geotechnical recommendations provided herein and to evaluate the acceptability of these recommendations for the actual site conditions.

9.0 LIMITATIONS

(a) Our investigation was performed in accordance with the usual and current standards of the profession, as they relate to this and similar localities. No other warranty, expressed or implied, is provided as to the conclusions and professional advice presented in this report.

(b) The samples taken and tested, and the observations made, are considered to be representative of the site; however, soil and geologic conditions can vary significantly between sample locations.

(c) As in most projects, conditions revealed during construction excavation may be at variance with preliminary findings. If this occurs, the changed conditions must be evaluated by the Project Geotechnical Consultant and the Geologist, and revised recommendations be provided as required.

(d) This report is issued with the understanding that it is the responsibility of the Owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the Architect and Engineer for the project and incorporated into the plans, and that properly Licensed Contractor and Subcontractors implement such recommendations in the field.

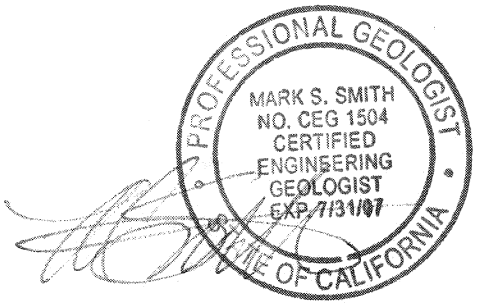
(e) This firm does not practice or consult in the field of safety engineering. We do not direct the Contractor's operations, and we are not responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the Contractor. The Contractor should notify the Owner if any of the recommended actions presented herein are considered to be unsafe.

they be due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge.

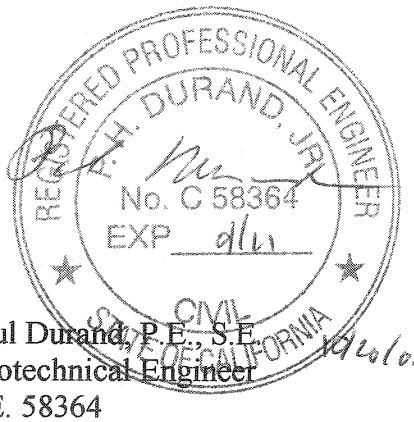
(g) Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

* * * * *

Respectfully Submitted,
C G I



Mark S. Smith, P.G.
Principal Geologist
C.E.G 1504
Expires 7/2011



Paul Durand, P.E., S.E.
Geotechnical Engineer
P.E. 58364
Expires 9/2011

Attachments:

Appendix A	-	List of References
Appendix B	-	Field Exploration Program
Appendix C	-	Laboratory Testing Program
Plate 1	-	Geotechnical Map


TENTATIVE TRACT 17325
LOT LAYOUT CONFIGURATION STUDY #4
FOR
KHALDA DEVELOPMENT
(COTO DE CAZA ESTATES)
GENERAL NOTES:
VICINITY MAP
LEGEND:
TRACT 13175
M.B. 631 / 1-6
TRACT 14505
M.B. 717 / 1-7
TRACT 14942
M.B. 717 / 24-32
TRACT 14504
M.B. 717 / 33-40
R.S. 84-1136
M.B. 108 / 25-29
TRACT 14337
M.B. 678 / 18-24
AREA TO REMAIN AS OPEN SPACE
PARCEL 1
TRACT 15245
VAN GOGH WAY
TRACT 15245
PROJECT ENTRY ENLARGEMENT DETAIL
LOT CONFIGURATION NOTES:
PRELIMINARY LOT CONFIGURATION STUDY #4
TABULATION BLOCK
PROPOSED PRIVATE ROADWAY/FIRE ACCESS
STREET SECTION
KHALDA DEVELOPMENT, INC.
CSL ENGINEERING, INC.
COUNTY OF ORANGE
TENTATIVE TRACT 17325
LOT LAYOUT CONFIGURATION STUDY #4
KHALDA DEVELOPMENT
(COTO DE CAZA ESTATES)

PLATE 1

REFERENCES

1. Morton, P.K., Greensfelder, R.W., 1976, Maps Showing Recency of Faulting, Relative Seismic Shaking, Liquefaction Potential and Earthquake Epicenters of Orange County, California, Plate 2B, in: Environmental Geology of Orange County, California, California Division of Mines and Geology Open File Report 79-8LA.

2. Ploessel, M.R., Slosson, J.E., September 1974, Repeatable High Ground Accelerations from Earthquakes, California Geology.

3. Seed, H.B., Idriss, I.M., 1982, Ground Motion and Soil Liquefaction During Earthquakes, Earthquake Engineering Research Institute Nomograph.

4. Seismic Design for Nuclear Power Plants, 1970, M.I.T. Press.

5. Jennings, C.W., 1975, Fault Map of California, California Division of Mines and Geology, Geologic Data Map No. 1.

6. Morton, P. K., 1970, Geology of the NE 1/4 and NW 1/4 Canada Gobernadora Quadrangle, California Division of Mines and Geology, Preliminary Report 10.

7. Morton, P. K. and Miller, R. V., 1981, Geologic Map of Orange County, California, showing mining and mineral deposits: California Division of Mines and Geology Bulletin 204, Plate 1.

8. Irvine Soils Engineering, Inc., 1989, Feasibility Investigation for Hunt Lodge Site, Coto de Caza, California, Job No: 01-6716-108-00-00, Log No: 9-9858.

AERIAL PHOTOGRAPHS

Date	Flight	Photo No.	Scale	Agency
2/26/53	AXK-5K	151-152	1 in. = 1,600 ft.	US Dept. of Agriculture

APPENDIX B

FIELD EXPLORATION PROGRAM

FIELD EXPLORATION PROCEDURES

1. The subsurface conditions were explored by drilling 20 bucket auger borings, ranging in depth from 50.5 to 100 feet below existing grade. The approximate locations of the borings are shown on the Geotechnical Map, Plates 1 through 8, attached. The field exploration was performed under the supervision of our Engineering Geologist who maintained a continuous log of the subsurface soils encountered, and obtained samples for laboratory testing.

2. Subsurface conditions are summarized on the logs of borings, Figures B-1 to B-20. The soils encountered were classified in accordance with the Unified Soils Classification System, (see Key to Logs, Figure B-0).

3. Drill holes were located in the field by pacing, working from the locations provided on a map. Elevations were determined by interpolation between contours on the 40-scale plans.

4. The following sampling and testing techniques were used to evaluate the subsurface conditions:

   a. Relatively undisturbed soil samples were obtained by means of a drive sampler. The corresponding drive energies per foot of penetration (ft-kip/ft) are indicated on the logs. These energies provide a measure of the relative density or consistency of the materials encountered.

   b. Relatively undisturbed samples were obtained using a 3-inch outside diameter California sampler lined with brass rings, each 1-inch long and 2-1/2 inch inside diameter. The brass rings were transferred into a plastic bag and sealed in a plastic tube immediately upon extraction from the borings. Bulk samples were also obtained.

5. The soils were classified based on field observations and laboratory tests.

FIELD EXPLORATION PROCEDURES

6. Ground water was not encountered. Minor ground-water seepage was observed in our bucket auger borings.

7. The borings were backfilled with drill cuttings at the completion of drilling.

8. Stratification lines on the logs represent the approximate boundary between predominant soil types. Minor layers of differing material types may be contained within the strata and a gradual transition should be expected between strata.

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

GRAIN SIZES

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
200	40	10	4	3/4"	3"	12"	

U.S. STANDARD SERIES SIEVE — CLEAR SQUARE SIEVE OPENINGS

RELATIVE DENSITY

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT*
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CONSISTENCY

CLAYS AND PLASTIC SILTS	STRENGTH**	BLOWS/FOOT*
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

*NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30-INCHES TO DRIVE A 2-INCH O.D. (1-3/8-INCH I.D.) SPLIT SPOON (ASTM D-1586).

**UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ. FT. AS DETERMINED BY LABORATORY TESTING OR APPROXIMATED BY THE STANDARD PENETRATION TEST (ASTM D-1586), POCKET PENETROMETER, TORVANE, OR VISUAL OBSERVATION

☒ RING SAMPLE ▯ STANDARD PENETRATION TEST ▨ BAG SAMPLE

DRILLING NOTES:

1. SAMPLING AND BLOW COUNTS
   - RING SAMPLER-DRIVE ENERGY (ft-kip/ft of penetration)
   - STANDARD PENETRATION TEST-NUMBER OF BLOWS PER 12 INCHES SHOWN
2. NR - NO RECOVERY
3. N - N-VALUE

KEY TO LOGS

JOB NO.:	DATE:	FIGURE:
01-6716-018-00-01	JULY 1989	B-0

IRVINE SOILS ENGINEERING, INC.

Job No: 01-6716-018-00-01 Log No: 9-1164

BORING LOGS B-1 TO B-5 ARE FROM OUR FEASIBILITY INVESTIGATION

JOB NO: 01-6716-018-00-00

LOG NO: 9-9858

FEBRUARY 20, 1989

DATE OBSERVED: 1-10-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 793 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-1

Sheet 1 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
0							LANDSLIDE DEPOSITS DERIVED FROM SANTAIGO FORMATION (Qls): @ 0' SILTSTONE (ML) with less than 5% fine to medium grained sand, pale grayish green, jointed, slightly moist, soft to moderately hard	J:N78E,90
5		5	20.1		9.2	123.0	@ 5' Silty SANDSTONE (SM), trace to some clay, pale yellow green, moist, moderately	J:N60W,74NE
10		5	20.1				@ 10' Sand content increases and more yellowish	B:N13W,20SW
15								
20		5	20.1		14.4	117.5	@ 19' Sandy SILTSTONE (ML) some clay, pale grayish green, wet, soft to moderately hard	B:N15,28W B:N15W,28SW
25								J:N70W,70NE
30							@ 30' Abundant high-angle shears and fractures; heavy seepage from sandstone	
35		7	16.4		17.7	111.7	@ 32' Silty SANDSTONE (SM) with clayey sandy SILTSTONE, pale yellowish brown, micaceous, slightly wet, loose to medium dense @ 35' Same as @ 32'	B:N5W,18SW

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-1.1

DATE OBSERVED: 1-10-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 793 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-1

Sheet 2 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
40							@ 42' Abundant high-angle fractures and shears; seepage heavy along fractures and shears	F:N15W,60NE
45								
50								
		18	38.9		16.1	118.1	@ 51.5' CLAY (CL), pale grayish blue, saturated, extensively fractured and sheared, firm to stiff	B:N16W,15SW RS:N16W,15SW
55							BEDROCK: SANTIAGO FORMATION (Tsa): @ 52' Silty CLAYSTONE (CL), pale bluish green, saturated, hard	
60								
65								
70								
75							@ 74' Caving: extensive spalling-off of bedrock along abundant high-angle shears	

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-1.2

DATE OBSERVED: 1-10-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 793 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-1

Sheet 3 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
80								
85							@ 84' Clayey SILTSTONE (ML), pale brown, wet, hard	
90							@ 88' Clayey SILTSTONE (ML), greenish blue, wet, hard, relatively less sheared than above 88'	
95							@ 94' Deepest extent of high-angle shears @ 95' Clayey silty SANDSTONE (SM), bluish green, wet, hard	S:N40E,53NW
100							TOTAL DEPTH 100' SHALLOWEST SEEPAGE @ 32' HOLE BACKFILLED	
105								
110								
115								

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-1.3

DATE OBSERVED: 1-11-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 806 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-2

Sheet 1 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
0							LANDSLIDE DEPOSITS DERIVED FROM TERRACE DEPOSITS (Qls): @ 0' Gravelly, cobbly, clayey silty SAND and clayey sandy SILT (GC) with boulders to 1.5 ft. diameter, yellowish brown, moist, dense	
5								
10		8	30.2		4.3	108.2	LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @ 6' Silty SANDSTONE (SM), fine to medium grained, pale yellowish brown, slightly moist, very dense	B:N2W,31NE J:N30W,67NE
							@ 11' Sandy clayey SILTSTONE (ML), pale brown, dry, moderately hard	B:N18E,37NW
15							@ 14' Clayey SILTSTONE (ML), pale brown, dry, moderately hard	
20								J:N28E,83NW J:N55E,84SE B:N73E,23NW
25							@ 22' Small scale shear with 1/2 inch wide zone of amastomosing hairline fractures with 1-1/4 inch apparent vertical displacement, NW block-up, SE block-down @ 24' Clayey silty SANDSTONE, fine to coarse grained, pale brown, dry, soft	FLT:N23E,62NW
30							@ 29.5' Clayey SILTSTONE (ML), pale brown, dry, soft to moderately hard	B:N7W,18SW
35		20	42.9		11.2	125.4	@ 32' Clayey SILTSTONE (ML), pale bluish gray, slightly moist, hard @ 35' Sandy SILTSTONE (ML) some clay, pale bluish gray, wet, hard	

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-2.1

DATE OBSERVED: 1-11-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 806 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-2

Sheet 2 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
40								
45								
50							@ 49' Jointing abundant	J:N5E,10NW
							@ 52' Clayey SILTSTONE, yellowish brown to olive, moist, hard	
55							@ 56' Fracture zone	F:N10E,60SE
60								
65							@ 65' Base to extensive jointing	
70							@ 70' Silty SANDSTONE, yellowish brown, slightly moist @ 72' 1 inch thick clay gouge	RS:N8W,15SW
		22	27.6		14.9	115.5	BEDROCK: SANTIAGO FORMATION (Tsa): Sandy SILTSTONE (ML) some clay, greenish blue, wet, hard	
75								S:N50E,90

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-2.2

DATE OBSERVED: 1-11-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 806 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-2

Sheet 3 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
80							@ 81', 6 inch thick, CLAYSTONE, greenish blue, grooved and straited @ 81.5' Clayey SILTSTONE, greenish blue, moist, hard	S:N5W,50W S:DUE N,49W STR:N90W
85							@ 85' Jointing sparse to absent	
90							@ 90' Clayey SILTSTONE, greenish blue, massive, moist, hard	
95							TOTAL DEPTH 95' NO GROUNDWATER HOLE BACKFILLED	
100								
105								
110								
115								

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-2.3

DATE OBSERVED: 1-13-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 817 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-3

Sheet 1 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
0							LANDSLIDE DEPOSITS DERIVED FROM TERRACE DEPOSITS (Qls): @ 0' Gravelley, cobbly, sandy silty CLAY (CL), yellowish brown to reddish brown, moist in upper 4', dry below 4', firm to very stiff	
15		12	43.5				LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @ 14' Clayey SILTSTONE (ML), greenish blue, moist, hard @ 17' 1" to 2" clay gouge	B:N28E,22SE RS:N5W,19SW STRIAT:N80E, 19NW
25								J:N8W,45SW S:N5W,42SW
35							@ 35' Same as @ 14', sand content increases	
							@ 39' Clayey SILTSTONE (ML), greenish blue,	B:N4E,22W

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-3.1

DATE OBSERVED: 1-13-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 817 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-3

Sheet 2 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
40							moist, moderately hard, extensive shears from 40' to 42'	S:N10W,25SW RS:N20W,12SW
							BEDROCK: SANTIAGO FORMATION (Tsa): @ 42' Clayey SILTSTONE (ML), greenish blue, moist, moderately hard	STRIAT:N70E, 12NW
45							@ 43' Extensive high-angle shears	S:N13W,57SW STRIAT: N76E,-56NW
							@ 48' Clayey silty SANDSTONE (SM), fine grained, greenish blue, massive, moderately hard @ 50.5' Slight seepage	
50							From 52' to 54' very clayey	
55								B:N10W,9W F:N40E,90
60							@ 60' Moderate seepage, caving to 65'	
							@ 61' Very clayey SILTSTONE (ML), greenish blue, massive, very moist, moderately hard	
65							@ 67' to 69' extensively sheared	
70							@ 69' Very clayey SILTSTONE (ML), very moist, moderately hard	S:N30E,45NW S:N13E,40NW
							@ 72' Silty SANDSTONE (SM), fine to coarse grained, grayish blue, moist, very hard	S:N56W,20SW
75								

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-3.2

DATE OBSERVED: 1-13-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 817 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-3

Sheet 3 of 3

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
80							@ 81' Lowest extent of joints	
85								
90								
95							@ 93' Clayey SILTSTONE (ML) with some fine sand, greenish blue, moist, massive	B:N30W,15SW
100							TOTAL DEPTH 100' SEEPAGE @ 50.5' HOLE BACKFILLED	
105								
110								
115								

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-3.3

DATE OBSERVED: 1-17-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 800 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-4

Sheet 1 of 2

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
0							COLLUVIUM (Qcol): @ 0' Sandy silty CLAY (CL), dark brown, moist, firm @ 3' Clayey silty SAND (SM), brown, moist, firm	
5								
10							LANDSLIDE DEPOSITS DERIVED FROM TERRACE DEPOSITS (Qls): @ 8' Gravel and cobble conglomeratic silty SAND (SP), yellowish brown with some boulders, massive, moist, medium dense	
15								
							@ 17'- 19' Abundant organic debri including roots, possible buried topsoil	
20								
25								
30								
35							@ 34' Very clayey SILTSTONE (ML), brown, moist, dense @ 36' Clayey silty SAND (SP), medium grained, brown, moist, medium dense to dense	

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-4.1

DATE OBSERVED: 1-17-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-A
LOGGED BY: SGM GROUND ELEVATION: 800 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-4

Sheet 2 of 2

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
40								
45								
50							LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @ 47' Clayey SILTSTONE (ML) with some sand, greenish blue, moist, moderately hard to hard	B:N26E,62NW
55							@ 52.5' Clay (CL) gouge, greenish blue, moist, soft BEDROCK; SANTIAGO FORMATION (Tsa): @ 53' Clayey SILTSTONE (ML), greenish blue, moist, hard	RS:N8W,13SW STRIAT: N90W,12W B:N9W,15SW
60								
65								
70							@ 70' Same as @ 53'	
75							TOTAL DEPTH 72' NO GROUNDWATER HOLE BACKFILLED	

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-4.2

DATE OBSERVED: 10-20-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-B
LOGGED BY: SGM GROUND ELEVATION: 743 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-5

Sheet 1 of 2

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
0							LANDSLIDE DEPOSITS DERIVED FROM COLLUVIUM (Qls): @ 0' gravelly clayey sandy SILT (ML), dark brown, moist, very soft, grass roots	
5		15	34.4		7.5	125.0	@ 5' Gravelly SAND (GP), some silt and clay brown, moist, very dense	
10							LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @ 10' Silty SANDSTONE (SM), some clay, very pale yellowish brown, moist, moderately hard	
15		7	17.2		7.9	121.7	@ 15' Same as @ 10'	
20								
25								
30		12	17.2		12.1	107.6	@ 30' Sandy SILTSTONE (ML) very fine grained sand with some clay, pale yellowish brown, moist, moderately hard 1 to 3 inches of light brown clay gouge	S:N14E,9NW RS:N14E,9NW B:N26E,17SE B:N77E,6SE
35							OLDER ALLUVIUM (Qalo): Silty SAND (SM), with dark brown to black laminae of carbonaceous matter Gravelly sand beds	

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-5.1

DATE OBSERVED: 10-20-89 METHOD OF DRILLING: 24" BUCKET AUGER
KELLY WEIGHTS: TYPE-B
LOGGED BY: SGM GROUND ELEVATION: 743 LOCATION: SEE GEOTECHNICAL MAP

LOG OF BORING NO. B-5

Sheet 2 of 2

DEPTH (FT)	CLASSIF-ICATION	BLOWS/FT	DRIVE ENERGY (FT-KIP/FT)	SAMPLE TYPE	MOISTURE CONTENT (%)	IN PLACE DRY DEN (LB/FT2)	DESCRIPTION	REMARKS
40					11.5	106.4		B:N35W,9SW
45							BEDROCK: SANTIAGO FORMATION (Tsa): @ 43' SANDSTONE (SP), fine to medium grained, yellowish brown, moist, moderately hard	B:N19W,33SW
50							@ 48.5' Hard	B:N29W,14SW B:N18W,11SW
55								B:N11W,17SW
							@ 56' Possible sand boil of greenish-blue sandstone upward into yellowish brown sandstone	
60		75	49.4		13.6	103.2	@ 58' SANDSTONE (SM), medium-fine grained, micaeous, greenish blue, moist, massive, hard	B:N30W,13SW
65							TOTAL DEPTH 65' NO GROUNDWATER HOLE BACKFILLED	
70								
75								

JOB NO.: 01-6716-018-00-00

IRVINE SOILS ENGINEERING, INC.

FIGURE: B-5.2

DATE OBSERVED: 2/20/82 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 667 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-6

TOTAL DEPTH 60'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SC	3.4	X		12.2	98.4	COLLUVIUM: Silty clayey SAND, dark brown-black, moist loose		
5	(SM) (SP)						BEDROCK: Santiago Formation (Tsa): Silty SANDSTONE, medium brown, moist, moderately hard, fine to medium grained, trace gravel and clay, becomes light yellow-brown, clay content decreases, becomes hard with trace to some fine to medium gravel with depth.		
10	(SM)						@9.5' Fractures closed @10' Thin beds of light grey-white silty SANDSTONE, fine grained		Fr:N52W,85NE Fr:N60W,72SW B:N61W,12NE
	(ML/CL)	33.5	X		19.5	107.2	Clayey SILTSTONE, red-brown to green-grey, mottled, moist, moderately hard, randomly fractured		B:N57E,21NW
15	(SM)						@12.5' Silty SANDSTONE, light yellow-brown, moist, dense, trace of fine to medium gravel		
20							@17.5' Silty SANDSTONE bed, very fine grained		B:N43W,9NE
25	(ML)						@25' Clayey SILTSTONE, - 6" thick, undulatory contact, randomly fractured		
	(SM)						@28' becomes light grey, micaceous, some fine gravel, medium grained		
30							@30' Silt and clay content increases, becomes fine grained, micaceous		
	(ML)		X		13.8	119.5	@32' Clayey SILTSTONE, some fine sand, blue-grey, moist, hard, ramdomly oriented shears 2 - shears that is cut by second		S:N81W,42NE S:N27W,60SW
35									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-6.1

DATE OBSERVED: 2/20/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 667 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-6

TOTAL DEPTH 60'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(ML/) (CL)	22.5	X		20.6	106.6	CLayey SILTSTONE/Silty CLAYSTONE, red-brown/green-grey, moist, moderately hard		
	(SM)						Silty SANDSTONE, some clay, very fine grained, slightly micaeous		
40									
45									
	(ML) (ML/) (CL)						@48' shear or minor fault with 1/8 to 1/2 inch clay gouge grades to sandy SILTSTONE sheared and fractured, 8 inch pieces		S:N34W,52NE
50							3" thick heavily sheared zone, some clay		S:N49W,17NE
	(SM)						Silty SANDSTONE, some clay, very fine grained, blue-grey, moist, hard, micaeous		
55									
60							TOTAL DEPTH 60' NO GROUNDWATER HOLE BACKFILLED		
65									
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-6.2

DATE OBSERVED: 2/20/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 686 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-7

TOTAL DEPTH 60'

DEPTH TO WATER 41.5/47/56

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SP	3.4	X		10.4	103.6	COLLUVIUM: Silty SAND with some clay, fine to medium grained, brown, moist, loose to medium dense		
5	(SM)						BEDROCK: SANTIAGO FORMATION: Silty SANDSTONE, pale brown, slightly moist, 5-10% porosity, soft to moderately hard (root mold and intergranular)		
10	(SM)	16.8	X		4.8	105.7	@ 10' Same as @ 4', pale yellowish-brown		
15									
20	(SM)	13.4	X		6.1	105.1	@20' Same as @ 10'		
25							@25' Same as @ 10', with some gravel, tabular shaped clasts of white clayey SILTSTONE		
30							@29' - 33' Same as @ 10', with irregularly shaped clasts of green clayey SILTSTONE, as large as 1.5 inches		B:N5E,16NW B:N20W,25SW B:N57E,12NW
35									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-7.1

DATE OBSERVED: 2/20/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 686 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-7

TOTAL DEPTH 60'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(ML)						@36' CLayey SILTSTONE, bluish-grey, brecciated, mixed with red and brown sand, no apparent shear surfaces		B:N45E,23NW
	(ML)								
40							@37' Clayey SILTSTONE, pale reddish-brown, moist		B:N-S,20W
	(SM)	22.5	X		16.5	115.4	@41.5' Silty SANDSTONE, red, 1.5" thick, well cemented, slight seepage		B:N5E,19NW
45									
	(ML)						@46' Clayey SILTSTONE, grayish-blue, moist moderately hard		B:N25W,15SW
							@46' Slight Seepage		
50									
55							@55' Clayey SILTSTONE, reddish-brown, moist, moderately hard to hard		B:N10E,15NW
							@56' Slight seepage, 1" thick clay layer below 56'		
60									
							TOTAL DEPTH 60' SLIGHT SEEPAGE @ 41.5', 47', 56' HOLE BACKFILLED		
65									
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-7.2

DATE OBSERVED: 2/21/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM/MSS ELEVATION: 754 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-8

TOTAL DEPTH 55'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SP	3.4	X		7.7	126.1	COLLUVIUM (Qcol): @0' SAND, fine to medium grained, trace clay, dark brown, moist, 10-20% porosity, loose to medium dense, gravel at base		
5	ML/ SM						COLLUVIUM/SLOPEWASH (Qsw): @4' Sandy clayey SILT to fine grained SAND, pale yellowish-brown, moist, soft to medium dense @8.5' Gravelly layer		
10							@10' Clayey SAND and SILT, gravelly, infilling channel		
15	SM						@15' Same as @ 4', gravelly with clasts of reddish-brown and bluish-grey clayey Silt and siliceous crystalline clasts		
20	(ML)	40.5	X		13.2	121.6	BEDROCK: SANTIAGO FORMATION (Tsa): @20' Clayey SILTSTONE, reddish-brown, moist, moderately hard		S:N-S, 40W B:N22E, 14NW
30	(ML)						@30' Clayey SILTSTONE, pale greyish-blue, moist, moderately hard to hard		B:N5W, 6SW
35									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-8.1

DATE OBSERVED: 2/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 754 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-8

TOTAL DEPTH 55'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(SM/) (ML)	64.3	X		9.6	125.5	@35' Silty SANDSTONE, fine grained to sandy SILTSTONE, pale yellowish-grey to pale greyish yellow, slightly moist		
	(SM)						@37' Silty SANDSTONE, fine to medium grained, grey, slightly moist, moderately hard		
40									
45									
	(ML)						@48' Clayey SILTSTONE, greyish-green, slightly moist, moderately hard to hard, contact @ 48' irregular and possibly burrowed		B:N4W, 7SW
50									
55							TOTAL DEPTH 55' NO GROUNDWATER HOLE BACKFILLED		
60									
65									
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-8.2

DATE OBSERVED: 2/21/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 704 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-9

TOTAL DEPTH 80'

DEPTH TO WATER 55'/61'/69'

DEPTH (FT.)	CLASSIFICATION	DESCRIPTION	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SM	COLLUVIUM: @0' Silty SAND, fine to medium grained, brown, dry to slightly moist, loose to medium dense	
5	(SM)	BEDROCK: SANTIAGO FORMATION: @2' Clayey Silty SANDSTONE, fine grained, yellowish-brown, moist, moderately hard to hard	
10		@10' As above, some well -rounded clasts of greyish-blue	
15			
20	(ML)	@20.5' Clayey SILTSTONE, reddish-brown, slightly moist, brecciated and sheared	S:N8W,17SW
25	(SM)	@21.5' Same as @ 2' @28' As above, gravel-size clasts of bluish-grey Siltstone	
30	(ML)	@30' Clayey SILTSTONE, greyish-blue with interbedded 1-2" thick reddish-brown beds, moist	B:N8WE,10NW
35	(ML)	@32' Clayey SILTSTONE, reddish-brown, moist, moderately hard	B:N3E,18NW

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-9.1

DATE OBSERVED: 2/21/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 704 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-9

TOTAL DEPTH 80'

DEPTH TO WATER 55',61'&69'

DEPTH (FT.)	CLASSIFICATION	DESCRIPTION	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(ML)	@35.5' Clayey SILTSTONE, greyish-blue, slightly moist, moderately hard	S:N3E,18NW STRIATIONS AND GROOVES: N87W,18SW
40	(SM)	@42' Sandy SILTSTONE, with clay, reddish-brown,moist,moderately hard	S:N7E,68NW J:N26W,85NE S:N80E,7NW
45	(ML)	@47' Clayey SILTSTONE, greyish-blue, moist, moderately hard	J:N26W,82SW J:N25E,65NW B:N13E,32NW
	(ML)	@47.5' Clayey SILTSTONE, pale brown, moist, moderately hard	
50	(ML)	@50' Clayey SILTSTONE, brown to greyish-blue, slightly moist, moderately hard, brecciated	B:N25E,15NW S:N45W,27S
	(ML/) (SM)	@52' Clayey SILTSTONE, greyish-blue, moist with interbedded pale yellowish-brown silty SANDSTONE, fine to medium grained, moist, moderately hard to hard	B:N40W,22SW
55	(SM)	@55.5' Sandy SANDSTONE, pale brown, slightly moist, moderately hard, heavy seepage from joints and fractures	J:N8E,68SE
60			
65			J:N5E,58SE
		@69' 1" thick CLAY GOUGE, greyish-blue, soft, moist, overlying CLAYEY SILTSTONE, greyish-blue, moderately hard to hard, moist	S:N10E,24NW
70	(ML)		

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-9.2

DATE OBSERVED: 2/21/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-9

TOTAL DEPTH 80'

DEPTH TO WATER 60', 61' & 69'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
70	(ML)						@74' Lowest occurence of joints		J:N8E, 68SE
75									
80							TOTAL DEPTH 80' SEEPAGE @ 60', 61' & 69' HOLE BACKFILLED Overnight seepage filled bottom 5' of hole		
85									
90									
95									
100									
105									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE:

DATE OBSERVED: 2/22/89 METHOD OF DRILLING: 24" BUcket Auger

LOGGED BY: RW ELEVATION: 754 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3365 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-10

TOTAL DEPTH 55'

DEPTH TO WATER 43'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SM						COLLUVIUM: (Qcol): Silty SAND, fine to medium grained, some roots, brown, slightly moist, loose, slightly porous		
5	(SP)	6.7	X		7.7	101.1	BEDROCK: SANTIAGO FORMATION (Tsa): SANDSTONE, fine - medium grained, light yellow-brown to pale yellow-brown, trace of coarse SAND, mottled FeO_2 stain, dry to slightly moist, trace silt		
10		32.0	X		6.5	118.8			
15									
20									
25									
30	(ML)	26.6	X		13.9	117.4	Clayey SILTSTONE, red-brown to blue-grey, slightly moist, hard		B:N60E, 5SE B:N50E, 8NW
35									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-10.1

DATE OBSERVED: 2/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 754 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-10

TOTAL DEPTH 55'

DEPTH TO WATER 43'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(SM)						Silty SANDSTONE, fine to medium grained, pale yellow-brown, slightly moist, hard, FeO_2 staining on bedding contact		
40							@40' becomes moist to very moist		
							@43' Seepage		
45	(ML)	26.6	X		13.4	120.1	Clayey SILTSTONE, red-brown to blue-grey, slightly moist to moist, hard, some sand		B:N10W, 10SW B:N5E, 7NW
50	(SM)						Silty SANDSTONE, very fine grained to fine grained, blue-grey, slightly moist, moderately hard, slight seepage		B:N41E, 9NW
55							TOTAL DEPTH 55' NO GROUNDWATER HOLE BACKFILLED		
60									
65									
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-10.2

DATE OBSERVED: 2/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 802 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-11

TOTAL DEPTH 56'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SC	16.8	X	/			COLLUVIUM (Qcol): Clayey SAND, some silt, fine to medium grained, some medium to coarse gravel, dark brown to medium yellow-brown, moist, firm		
5									
	(SM)	13.4	X				BEDROCK: SANTIAGO FORMATION (Tsa): Silty SANDSTONE, fine to medium grained, trace of coarse SAND, light grey to yellow-brown, slightly moist, moderately hard, mottled FeO_2 staining		B:N14W,13SW
10									B:N3W,9NE
15				/					
20									
	(ML)						Clayey SILTSTONE, light green-brown, slightly moist, moderately hard		B:N42E,16SE
25	(SM)						Silty SANDSTONE, fine to medium grained, pale yellow-brown, moderately hard to hard, slightly moist, mottled FeO_2 staining, increase in silt @ 27'		Fr:N10E,39NW
30									
35									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-11.1

DATE OBSERVED: 2/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 802 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-11

TOTAL DEPTH 56'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35									
	(SM)								
40									
	(ML)	32.7	X		15.1	118.4	Clayey SILTSTONE, light blue-grey to red-brown, slightly moist, hard, FeO_2 staining on bedding contact, some sand		B:N20W,7SW
45									B:N3W,14SW
	(SP)						SANDSTONE, very fine to fine grained, blue-grey, slightly moist, hard		
50									
55		32.7	X		13.4	120.1			
							TOTAL DEPTH 56' NO GROUNDWATER HOLE BACKFILLED		
60									
65									
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-11.2

DATE OBSERVED: 2/23/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 824 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-12

TOTAL DEPTH 55'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	ML	10.1	X	/			COLLUVIUM (Qcol): Clayey SILT, brown, slightly moist, soft to firm, small amount of caliche		
5	(SP)						BEDROCK: SANTIAGO FORMATION (Tsa): SANDSTONE, very fine to fine grained, trace to small amount of clay, light grey to yellow-brown, dry to slightly moist, moderately hard		C:N5W,35NW B:N5W,16NW
10	(ML)						Clayey SILTSTONE, green-brown to red-brown, slightly moist, hard		B:N50W,7NW B:N22W,33NW
15	(SP)			/			@13' trace of coarse sand SANDSTONE, fine to medium grained, light grey to yellow-brown, slightly moist, hard, red-brown mottled FeO_2 staining		
20									
25							@24' increase in grain size @26' decrease in grain size		
30							@32' 2 - discontinuous fractures, closed, no staining		
35							@35' increase in FeO_2 staining		

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-12.1

DATE OBSERVED: 2/23/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 824 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-12

TOTAL DEPTH 55'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	SP								
									B:N22W,20NW
	(ML)						Clayey SILTSTONE, green-brown, slightly moist, hard, FeO_2 staining along contact		
40	(SP/) (ML)						SANDSTONE, very fine to fine grained, interbedded with clayey SILTSTONE, yellow-brown to green-brown, slightly moist, moderately hard		B:N18W,15NW
45									B:N22W,13NW
	(SP)						SANDSTONE, fine grained, slightly oxidized, light yellow-brown to pale yellow-brown, slightly moist, hard @49' becomes medium grained with trace of fine gravel		
55							TOTAL DEPTH 55' NO GROUNDWATER HOLE BACKFILLED		
60									
65									
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-12.2

DATE OBSERVED: 2/23/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 696 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-13

TOTAL DEPTH 60'

DEPTH TO WATER 58'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SC						COLLUVIUM: Clayey SAND, very fined grained to fine grained, brown-black to brown, slightly moist, soft to firm		
		6.7	X				LANDSLIDE (Qls): Clayey SILT and SAND, fine to medium grained, some roots, light to medium brown, moist, firm		
5							@6' trace of fine gravel		
	ML	13.4	X				@9' minor fracturing, increase in silt		
10									
	SM						Silty SAND, light grey-brown, mottled with red-brown Silty Sand and Clayey Silt, moist, dense to very dense		B:N45W,17NW
15							@14' 6" round Colluvium pocket		
	SM	13.4	X				OLDER ALLUVIUM/COLLUVIUM: Silty SAND, some clay, medium red-brown, moist, dense to very dense, roots and some carbonaeous matter		RS:N10W,12NW
20									B:N15W,12NW
	(SM)								B:N60W,24NW
25							BEDROCK: SANTIAGO FORMATION (Tsa): Silty SANDSTONE, fine to medium grained, light grey to yellow-brown, slightly moist to moist, moderately hard		
							@23' SANDSTONE, 2-4" bed, green-brown, dry, hard, roots, trace to some fine grained red-brown mottled FeO_2 staining		B:N80W,20NW
30	SM						@26' Clayey SANDSTONE, fine to medium grained, yellow-brown, slightly moist, hard		
							@31' moisture increases		
35							@35' minor fracturing		

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-13.1

DATE OBSERVED: 2/23/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 696 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-13

TOTAL DEPTH 60'

DEPTH TO WATER 58'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35									
	(SM)						@39' moisture increases		
40									
							@44' seepage from fractures		Fr:N3W,55NW
45		32.7	X						
							@48.5' Silty SANDSTONE, fine to medium grained, some coarse grain, blue-grey, wet, hard		B:N25W,14NW B:N10W,12NW
50	(ML)	42.9	X	/			Clayey SILTSTONE red-brown, interbedded with clayey SILTSTONE, blue-grey, wet hard		B:N10W,15NW
55	(SP)						SANDSTONE, very fine grained to fine grained with trace of clay, blue-grey, wet		
60							TOTAL DEPTH 60' GROUNDWATER @ 58' HOLE BACKFILLED		
65									
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-13.2

DATE OBSERVED: 2/26-2/27/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 662 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-14

TOTAL DEPTH 55'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	(SP)						BEDROCK: SANTIAGO FORMATION (Tsa): SANDSTONE, fine to medium grained, light grey to white, dry to slightly moist, moderately hard,		
5							@5' trace of organic debris infilling fractures to 5'		
10	(ML)	36.9					Clayey SILTSTONE, trace of fine to medium grained sand, green-grey, dry, hard		B:N40W, 7SW
15							@13' increase in sand		
20	(SM/ ML)						Sandy SILSTONE, fine grained, olive-brown, slightly moist, hard, trace of mottled FeO_2 staining		
25							@21' color change to light grey to white decrease in cilt, increase in sand		
30									B:N75E, 11SE
35		43.6					@32' Silty SANDSTONE, fine grained, green-grey, slightly moist, hard, FeO_2 staining on bedding contact		B:N50E, 17SE

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-14.1

DATE OBSERVED: 2/26-2/27/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 662 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-14

TOTAL DEPTH 55'

DEPTH TO WATER N/A

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35									B:N50E,23NW
40	(SP)						SANDSTONE, fine to medium grained, light grey to white, slightly moist, moderately hard, some silt, trace to some clayey silt, FeO_2 staining on bedding contact @40' ¼ to ½ inch green-grey clay, slightly moist, firm, FeO_2 staining on bedding contact		B:N45E,35NW
45							@44.5' trace of coarse grains @46' FeO_2 staining on bedding contact		B:N15E,7NW
50	(SM)						Silty SANDSTONE, fine to medium grained, green-grey, slightly moist, hard, FeO_2 staining on bedding contact		B:N22E,24NW
55							TOTAL DEPTH 55' NO GROUNDWATER HOLE BACKFILLED		
60									
65									
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-14.2

DATE OBSERVED: 2/27/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 636 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-15

TOTAL DEPTH 60'

DEPTH TO WATER 54'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	SC	10.1	X				TOP SOIL: Clayey SAND, dark brown to brown, slightly moist, soft to firm, roots, some clayey silt		
5	SP	6.7	X				ALLUVIUM/COLLUVIUM (Qac): SAND, fine grained, medium brown, moist, medium dense, roots @5' some fine to medium gravel, trace to small amount of silt		
10		13.4	X				@6' decrease in silt, increase in grain size @9.5' becomes moist with trace of clay @11.5' becomes medium grained		
15									
20		13.4	X				@19.5' becomes dense, trace of coarse grains Sand and clayey SAND, fine to medium grained, dark to medium brown, moist		
25	SM/ SC						@24.5' trace of carbonaceous debris @27' clay content decreases @29' sand content increases, medium grained		
30		8.2	X				@31.5' - 32.5' dark brown, interbedded clay layers, moist, firm @34.5' 4" clay layer		
35									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-15.1

DATE OBSERVED: 2/27/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RW ELEVATION: 636 LOCATION: See Geotechnical Map

KELLY WEIGHTS 3355 lb. TO 30 FEET 2045 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-15

TOTAL DEPTH 60'

DEPTH TO WATER 54'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	SM/ SC								
40	ML						PALEOSOL: CLayey sandy SILT, dark brown, moist, firm to hard, trace rootlets		B:N17E,8NW
									B:N22E,10NW
45	SM						BEDROCK: SANTIAGO FORMATION (Tsa): Silty SANDSTONE, fine to medium grained, trace of gravel, yellow-brown, moist to very moist, moderately hard		CS:N22E,19NW
							@45.5' Silty CLAYSTONE - 1" bed, light grey, moist to very moist, moderately hard		B:N22E,20NW
50							@48' Clayey SANDSTONE - 1" bed, light grey		
							@49' increase in grain size, medium to coarse		
							@52' moisture increase to wet		F:N50E,48NW
55							@53' red-brown mottling		B:N40W,8SW
							@54' slight seepage, ¼ - ½ inch clay-filled fractures		
							@54.5' Silty SANDSTONE - 4" bed, blue-grey, medium dense		
60							TOTAL DEPTH 60' SEEPAGE @ 54' HOLE BACKFILLED		
65									
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-15.2

DATE OBSERVED: 5/18/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 762' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-16

TOTAL DEPTH 60'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	ML/ SM						LANDSLIDE DEPOSITS DERIVED FROM COLLUVIUM (Qls): @3' Sandy SILT to silty SAND, gravelly, pale yellowish brown, dry		
10	ML/ SM						LANDSLIDE DEBRIS DERIVED FROM TERRACE DEPOSITS (Qls): @8' Sandy SILT to silty SAND, gravelly, dark brown, dry, very dense		
	(ML)	5			17.8	112.4	LANDSLIDE DEBRIS DERIVED FROM SANTIAGO FORMATION (Qls): @12' Sandy clayey SILTSTONE, pale yellowish brown, slightly moist		RS:N80E,17SE
20	ML						LANDSLIDE DEBRIS DERIVED FROM TERRACE DEPOSITS (Qls): @14.6' Clayey sandy SILT to clayey silty SAND, dark brown to reddish-brown, with abundant gravel and cobbles @16.6'		
	(CL)	6					@23' Silty CLAY, olive-green, moist, plastic, gouge material		
30	(ML)				23.8	99.8	LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @26' Clayey SILTSTONE, pale olive green, slightly moist, moderately hard, rupture surface @32'		RS:N12W,17SW
	(SM/) (ML)						BEDROCK: SANTIAGO FORMATION (Tsa): @32' Interbedded SANDSTONE and SILTSTONE, pale yellow-brown and olive green, slightly moist, moderately hard		BRS:N69W,26SW
35	(SC)						@35' Clayey silty SANDSTONE, pale yellowish		G:N13W,62SW

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-16.1

DATE OBSERVED: 5/18/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 762' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-16

TOTAL DEPTH 60'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(SC)						brown, slightly moist, hard		
40	(ML)						@38' Clayey SILTSTONE, some fine to medium grained sand, greyish-blue, slightly moist, hard		B:N2E,24W
45									
50	(SM)						@49' Clayey silty SANDSTONE, greyish-blue, slightly moist, moderately hard		
	(ML)						@53' 1 foot thick SILTSTONE bed, brecciated zone above unstriated but polished shear surface		S:N20E,32NW
55	(SM)	24	X		15.2	117.1			
							@54' Clayey silty SANDSTONE, fine grained dark greyish-blue, slightly moist, hard		B:N20E,32W B:N7W,10SW
60							TOTAL DEPTH 60' NO GROUNDWATER HOLE BACKFILLED		
65									
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-16.2

DATE OBSERVED: 5/18/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 775' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-17

TOTAL DEPTH 70'

DEPTH TO WATER 63'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	(SP)						LANDSLIDE DEPOSITS DERIVED FROM COLLUVIUM (Qsl): @1' Clayey Silty SAND, gravelly, brown, dry, loose to medium dense		
5	(SP/) (GM)						LANDSLIDE DEBRIS DERIVED FROM TERRACE DEPOSITS (Qls): @3' CLayey Silty SAND, gravelly with well rounded clasts, dry, medium dense		
10	(SM)	5			10.7	115.2	LANDSLIDE DEPOSITS DERIVED FROM SANTIAGO FORMATION (Qls): @7' Clayey silty SANDSTONE, fine grained, pale yellowish-brown, slightly moist, moderately hard		B:N10W,65NE
	(SM)						@12' Same as @7', upper 4 inches is brecciated		B:N10E,23SE
15	(ML)	10			10.4	121.4	@14' Sandy clayey SILTSTONE, greyish-brown, slightly moist, moderately hard to hard		B:N18E,15W
							@15' Abundant fractures and joints		J:N12W,59SW
	(SM)						@16' Clayey silty SANDSTONE, fine to medium grained, moist, moderately hard		B:N43W,24SW
20									S:N45E,78SE
	(ML)						@20.6' Clayey SILTSTONE, slightly moist, moderately hard to hard		LINEATION: N60E,25NE
									B:N5E,10W
25									
30							@29' Poorly developed joints		J:N5E
35									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-17.1

DATE OBSERVED: 5/19/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: SGM ELEVATION: 775' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-17

TOTAL DEPTH 70'

DEPTH TO WATER 63'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35									
	(ML)						@36' Clayey Silty SANDSTONE, fine to medium grained, greyish-blue, moist, moderately hard to hard		
40							@44' Same as @36', harder		RS:N12E,15NW
45	(ML)						@45' Clayey SILTSTONE, greenish-grey, moist, moderately hard to hard		B:N31W,16SW
	(ML)						@46' Same as @36', hard due to cementation		
50							@51' Brecciated to 53'		S:N24W,13SW
	(CL/ML)						@53' Silty CLAY to clayey SILT, greyish-blue, moist, plastic		RS:N46E,24NW
55	(SM)						BEDROCK: SANTIAGO FORMATION (Tsa): @54' Clayey silty SANDSTONE, fine grained, greyish-blue, moist, moderately hard to hard		B:N5W,11SW
60	(SM)						@62.5' Clayey silty SANDSTONE, fine to medium grained, greyish-blue, slight seepage		B:N15W,23SW
65	(SM)						@63' Clayey silty SANDSTONE, fine grained, greyish-blue, moist, moderately hard to hard		
70							TOTAL DEPTH 70' SEEPAGE @ 63' BRS @ 54' HOLE BACKFILLED		

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-17.2

DATE OBSERVED: 5/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 783' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-18

TOTAL DEPTH 70'

DEPTH TO WATER 48' & 54'

DEPTH (FT.)	CLASSIFICATION	DESCRIPTION	GEOLOGIC ATTITUDES AND SOIL TESTS
0	(SM)	COLLUVIUM: Silty SAND, fine to medium gravel, trace medium cobble, abundant rootlets, dry, loose	
5	(ML)	LANDSLIDE DEBRIS DERIVED FROM SANTIAGO FORMATION (Qls): Sandy SILTSTONE, light green-grey, dry, firm, mottled with colluvium, fractures infilled with slopewash, moisture content increases @4', becomes sandy Siltstone, silty Sandstone mottled	S:N27W,14SW
10	(SM)	@7' Silty SANDSTONE, fine grained, light yellow-brown, moist, dense @10' Distrubed bedding surface irregular, thin interbeds of clayey Siltstone	B:N19W,10SW
15	(ML)	@12' Becomes fine to medium grained, blue-grey, medium dense @14' Becomes light blue-grey @16' Clayey SILTSTONE, thin bed, medium blue-grey, sheared contact	B:N7E,13NW
20	(ML/) (SM)	@18' Mottled Silty SANDSTONE and clayey SILTSTONE, ramdomly sheared	
	(SC)	@22' 1' thick disturbed silty clayey SANDSTONE, moist, loose	
25	(SM)	@23' Silty SANDSTONE, partially cemented grey-white, very hard @25' Becomes fine to medium grained, hard, trace fine gravel, inclusions of blue-grey clayey SILTSTONE	
30		@29' Silty SANDSTONE, fine grained, with medium blue-grey clayey SILTSTONE interbeds	
		@31' Silty SANDSTONE, medium green-grey, moist, hard, fine to medium gravel	Fr:N44W,79NE
35	(SM/) (ML)	@33' fracture infilled with clayey SILTSTONE, disturbed @34' Clayey SILTSTONE and silty SANDSTONE	

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-18.1

DATE OBSERVED: 5/22/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 783' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-18

TOTAL DEPTH 70'

DEPTH TO WATER 48 & 54

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35							thinnly interbedded, disturbed @36' Silty SANDSTONE, fine grained, light blue-grey @39' Clayey silty SANDSTONE, very fine grained		
40									
45	(ML)						Clayey SILTSTONE, medium blue-grey, moist, soft, very disturbed, randomly sheared and fractured		RS:N33W,16SW
50	(SM)						BEDROCK: SANTIAGO FORMATION (Tsa): CLayey SILTSTONE, medium blue-grey, moist, hard to very hard, sand content increases @48.5' Slight seepage above fault Silty SANDSTONE, very fine grained, medium blue-grey, moist, moderately hard to hard		S:N37W,14SW F:N60E,37NW B:N22W,16SW
55	(ML)						Clayey SILTSTONE, medium blue-grey, moist, hard, moderate seepage, water perched on Fault, sand content increases		F:N15E,57NW
60	(SM)						Silty SANDSTONE, mottled red-brown and blue-grey, moist, hard, trace fine gravel @58' Fine to medium grained, very hard, massive		
65							TOTAL DEPTH 70' SEEPAGE @ 48.5' & 54' HOLE BACKFILLED		
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-18.2

DATE OBSERVED: 5/23/89 METHOD OF DRILLING: 24' Bucket Auger

LOGGED BY: MSS ELEVATION: 810' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-19

TOTAL DEPTH 65'

DEPTH TO WATER 45' & 51'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	(SM)						COLLUVIUM: Silty SAND, gravelly, dark brown, dry, loose, trace clay, trace small boulders		
	(SM)						LANDSLIDE DEBRIS: Silty SAND, light yellow-brown, fractures infilled with slopewash		
5	(SM/) (ML)	3	X		19.8	105.2	Clayey silty SAND and clayey SILT, mottled, light grey-brown, moist, soft, loose		
	(SM)						@7' Clayey silty SANDSTONE, very fine grained, light green-grey, moist, soft to medium hard		
10							@9' fine to medium grained, light grey, moderately hard		
							@12' shear 1/8" clay gouge		S:N46E,59NW
15									
							@18' light blue-grey, partially cemented, hard, clay content increases, thin bed of clayey Siltstone, disturbed contact		B:N23E,38NW
20									
25									
	(ML)						@28.5' Sandy SILTSTONE, some clay, moist, moderately hard		
30		4	X		11.6	126.4	@29'-30' sheared zone, moist, soft		
							@30.5' Landslide surface, 1" thick clay Gouge		S:N2E,11NW RS:N20W,17SW
	(ML)						@30.5'-31' Clayey SILTSTONE ramdomly sheared fractured, slightly moist, moderately hard, slightly disturbed		S:N6E,13NW
35	(SM)						@32' Shear below shear, becomes hard @34' light blue-grey, sand content increases		

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-19.1

DATE OBSERVED: 5/23/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 810' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2050 lb. TO 58 FEET 1215 lb. TO 85 FEET

BORING NO. B-19

TOTAL DEPTH 65'

DEPTH TO WATER 45' & 51'

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35	(SM)						@35' Silty SANDSTONE, fine grained, moist, hard		
							@39' Light grey, moisture content increases		
40							@40' Medium to coarse grained		
							@43' Clayey silty SANDSTONE, very fine grained, moist, moderately hard		B:N12W,14SW
45							@45'-46' very slight seepage, sheared zone, ½" clay gouge		S:N51W,12SW Stria:N7W
		40/ 10"	X				@46' Sand content increases, fine to medium grained		BRS:N38W,15SW Stria:N8W
	(SM)						@47' Very fine grained, clayey @47.5' Landslide surface, ¼" clay gouge		
50							BEDROCK: SANTIAGO FORMATION (Tsa): Silty SANDSTONE, light blue-grey, moist, hard, slight seepage @51.5', water perched, on clayey fine sandstone bed, 8" thick		
55							@57' Fine to medium grained, light grey, partially cemented		B:N27W,11SW B:N37W,12SW B:N24W,14SW
60	(ML)						Sandy SILTSTONE, some clay, red-brown, moist, hard		B:N12W,12SW
							@60.5' Silty SANDSTONE, fine to medium grained, light blue, moist, hard		
65							@63' Medium to coarse grained, massive		
							TOTAL DEPTH 65' SEEPAGE @ 45' & 51' BRS @47.5' HOLE BACKFILLED		
70									

JOB NO.: 01-6716-018-00-01

LOG OF BORING

FIGURE: B-19.2

DATE OBSERVED: 5/26/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 794' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-20

TOTAL DEPTH 65'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
0	(SM)						LANDSLIDE DEBRIS DERIVED FROM TERRACE DEPOSITS (Qls): @0' Silty SAND, some gravel, medium to dark brown, dry to slightly moist, loose to medium dense, very porous		
5	SM/ SC						LANDSLIDE DEBIRS DERIVED FROM SANITAGO FORMATION (Qls): Silty clayey SAND, fine grained, slightly moist, medium dense, trace rootlets,		
10									
15							@15.5' 3" of clay gouge		RS:N45W,12SW
	ML	2	X		23.0	102.9	@16' Silty sandy CLAY, fine grained, light greyish-brown, very moist, very loose		
20							@20' Sand content increases, fine to medium grained, hard @20.5' Silt and clay content increase, fine grained		S:N17E,23NW STRIATIONS: N70E
	(ML)	13	X		11.5	123.4	@22' Sandy SILTSTONE, some clay, fine grained sand, randomly sheared 1"-3" pieces		
25	(ML)						@25' Landslide surface 1" of clay gouge		RS:N32W,14SW STRIATIONS: S:N66W,44SW
							BEDROCK: SANTIAGO FORMATION (Tsa): @26' Sandy SILTSTONE, greyish-blue, moist, moderately hard		
30									
	(SM)						@31.5' Clayey silty SANDSTONE, grey-blue, moist, moderately hard		
35									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-20.1

DATE OBSERVED: 5/26/89 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: MSS ELEVATION: 794' LOCATION: See Geotechnical Map

KELLY WEIGHTS 3350 lb. TO 30 FEET 2045 lb. TO 58 FEET 1200 lb. TO 85 FEET

BORING NO. B-20

TOTAL DEPTH 65'

DEPTH TO WATER NGW

DEPTH (FT.)	CLASSIFICATION	DRIVE ENERGY (FT.KIP/FT.)	UNDISTURBED	BULK SAMPLE	MOISTURE	CONSISTENCY/ DENSITY	DESCRIPTION	GRAPHIC LOG	GEOLOGIC ATTITUDES AND SOIL TESTS
35									
							@41' fine to medium grained, light green-grey, moist, hard		
40									
		13			14.3	119.8	@45' Silt and clay content increases, very fine grained		
45	(SM/) (ML)						@46' Sheared bed, silty SANDSTONE to sandy SILTSTONE, very fine grained, thinnly bedded, light blue-grey, moist, hard		SB:N44W,11SW
50	(ML)						@50' Sandy clayey SILTSTONE bed 6" thick grades to light blue-grey silty SANDSTONE, moist, hard		B:N11W,9SW B:N8W,14SW
	(SM)								
55									
60	(ML)						@59' Thin clayey SILTSTONE bed, 2" thick		B:N19E,11NW
	(SM)	25/6"			9.5	119.6	@60' Silty SANDSTONE, fine to medium grained, bluish-grey, moist, hard, massive		
65							TOTAL DEPTH 65' NO GROUNDWATER HOLE BACKFILLED		
70									

JOB NO.: 01-6716-018-00-01 LOG OF BORING FIGURE: B-20.2

APPENDIX C

LABORATORY TESTING PROGRAM

LABORATORY TESTING PROCEDURES

1. Classification

a. Soils were classified visually according to the Unified Soil Classification System. Moisture content and dry density determinations were made for representative, undisturbed samples.

b. Results of moisture-density determinations, together with classifications, are shown in the Logs of Borings, in Appendix B.

2. Maximum Dry Density/Optimum Moisture Content

The maximum dry density/optimum moisture content relationship was determined for representative samples of the on-site soils. The laboratory standard used was ASTM: D 1557. The results are presented in Table C-1.

3. Direct Shear

Direct shear strength tests were performed on representative, relatively undisturbed samples of the on-site soils, and on remolded samples. To simulate possible adverse field conditions, the samples were saturated prior to shearing. A saturating device was used which permitted the sample to absorb moisture while preventing volume change. The test results are presented in Table C-2.

4. R-Value

R-Value tests were performed on representative samples of the on-site surface soils. The laboratory standards used was ASTM: D 2844. The test results are presented in Table C-3.

5. Consolidation

Consolidation tests were performed on representative, relatively undisturbed samples of the underlying soils to determine compressibility characteristics. The samples were saturated during the tests to simulate possible adverse field conditions. The test results are presented in Figures C-1.1 through C-1.5.

6. Sulfate Content

The sulfate content was determined for 1 sample per California 417. The result is presented in Table C-4.

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TABLE C-1
OPTIMUM MOISTURE CONTENT/MAXIMUM DRY DENSITY TEST RESULTS
(ASTM: D 1557)

Test Location	Classification	Optimum Moisture Content (%)	Max. Dry Density(lb/ft^3)
B-1 @ 5'	Silty SANDSTONE	12.1	121.9
B-1 @ 34'	Silty SANDSTONE/ Clayey sandy SILTSTONE	16.2	110.0
B-5 @ 40-43'	Gravelly silty SAND	11.3	121.8
B-6 @ 1-3'	Silty clayey SAND	10.6	121.5
B-7 @ 10-13'	Silty SANDSTONE	10.9	121.9
B-10 @ 4-6'	Silty SANDSTONE	13.3	118.9
B-16 @ 3-5' and 8-10'	Gravelly sandy SILT to silty SAND	8.8	129.9
B-17 @ 6'	Gravelly clayey silty SAND	8.9	130.9
B-18 @ 15-16'	Silty SANDSTONE to clayey SANDSTONE	10.7	126.2
B-19 @ 30'	Sandy SILTSTONE	15.1	112.7
B-20 @ 1-10'	Silty clayey SAND	10.3	126.7

TABLE C-2
SHEAR STRENGTH TEST RESULTS

Sample Location	Classification	Peak		Residual		Reshear	
		Cohesion (lb/ft^2)	Angle of Frict. (°)	Cohesion (lb/ft^2)	Angle of Frict. (°)	Cohesion	Angle of Frict. (°)
B-1 @ 5'	Silty SANDSTONE U.	572	42	155	32	---	---
B-1 @ 5'	Silty SANDSTONE R.	46	34	46	34	---	---
B-1 @ 52'	Silty CLAYSTONE U.	1439	7	823	13	---	---
B-5 @ 15'	Silty SANDSTONE U.	412	36	119	35	---	---
B-5 @ 42'	Silty SAND U.	333	22	287	23	---	---
B-1 @ 52'	Silty CLAYSTONE U.	-	-	-	-	260	24
B-7 @ 10'	Silty SANDSTONE U.	0	38	0	38	---	---
B-8 @ 21'	Clayey SILTSTONE U.	1700	31	320	22	---	---
B-10 @ 10'	Silty SANDSTONE U.	1100	38	160	31	---	---
B-10 @ 33'	Silty SANDSTONE U.	1550	32	0	33	---	---
B-11 @ 42'	Clayey SILTSTONE U.	760	33	190	27	---	---
B-16 @ 12'	Sandy SILTSONTE U.	887	32	430	33	571	20
B-16 @ 2'	Silty CLAY w/ Sand R.	595	3	522	4	490	5
B-16 @ 26	Clayey SILTSTONE U.	905	27	484	22	---	---
B-16 @ 54'	SANDSTONE U.	329	42	0	35	33	30
B-17 @ 9'	Silty SANDSTONE U.	489	37	283	33	---	---
B-17 @ 15'	Sandy SILTSTONE	649	49	0	39	---	---
B-19 @ 29'	Sandy SILTSTONE U.	174	41	329	21	---	---
B-20 @ 17'	Sandy CLAY U.	1170	20	709	25	---	---
B-20 @ 22'	Sandy SILTSTONE U.	1563	32	0	40	---	---
B-20 @ 44'	Silty SANDSTONE U.	0	49	0	37	---	---

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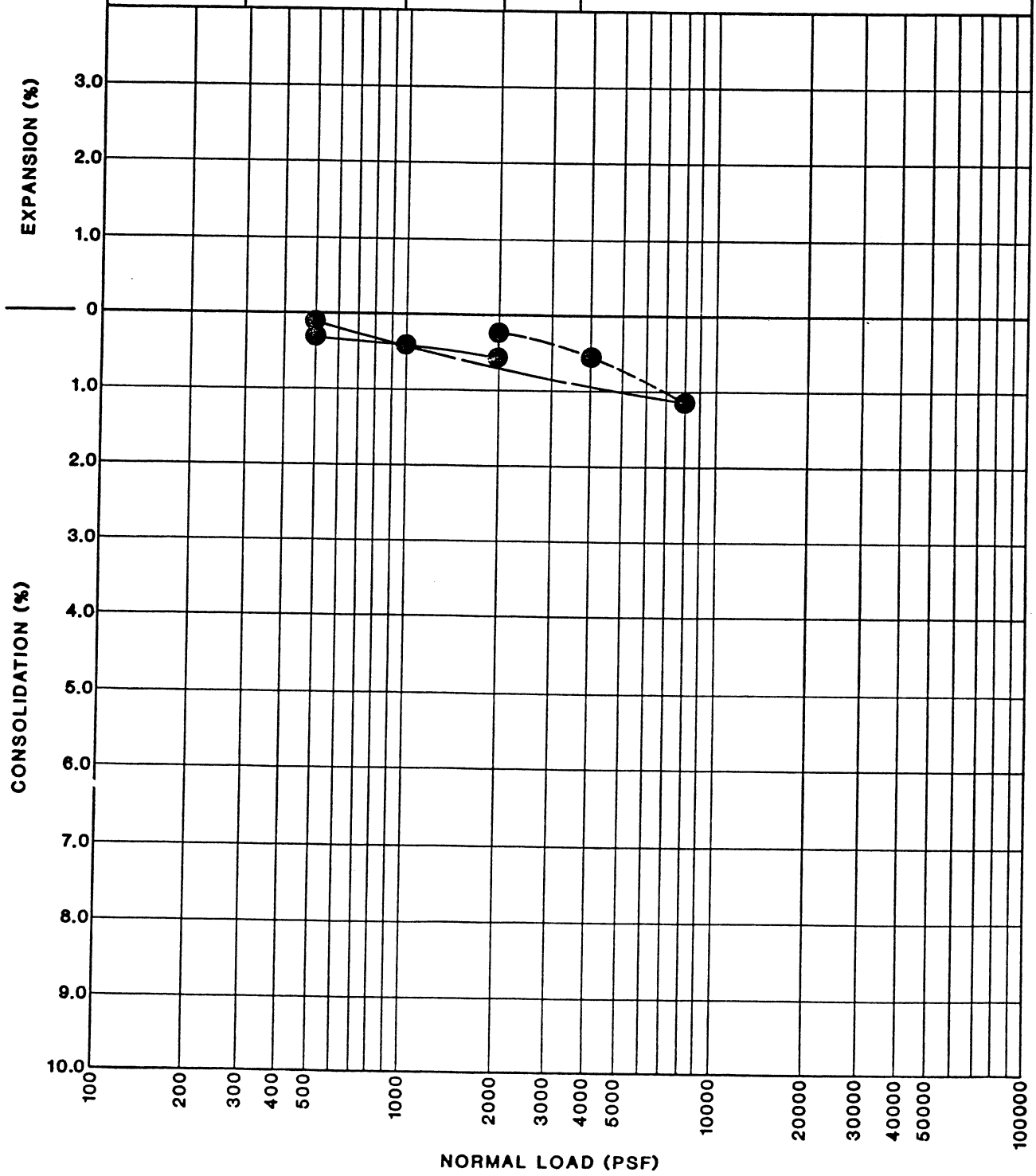
TABLE C-3
R-VALUE TEST RESULT
(ASTM: D 2844)

Test Location	Classification	R-Value
B-6 @ 2'	Silty clayey SAND	11
B-10 @ 4-6'	SANDSTONE	8

TABLE C-4
WATER SOLUBLE SULFATE CONTENT TEST RESULTS
(California 417)

Test Location	Soil Classification	Soluble Sulfate (%)
B-1 @ 5'	Silty SANDSTONE	0.0160

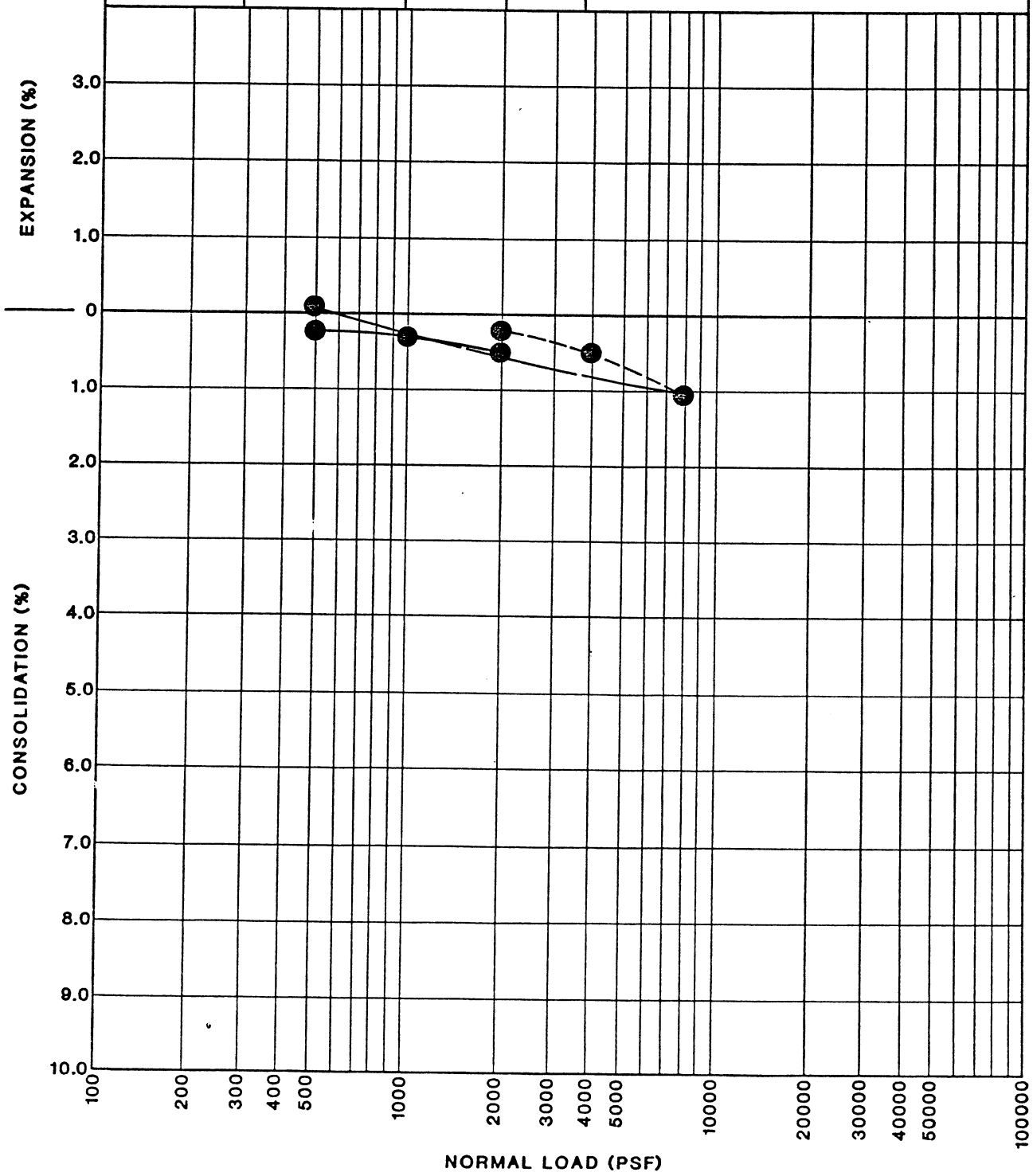
BORING NO.	DEPTH (FEET)	SYMBOL	SOIL TYPE	EXPLANATION
B-1	5.0	●	(SM)	FIELD MOISTURE
(SILTY SANDSTONE)				SAMPLE SATURATED
				REBOUND



JOB NO.:		FIGURE:
01-6716-018-00-01	CONSOLIDATION TEST RESULTS	C-1.1

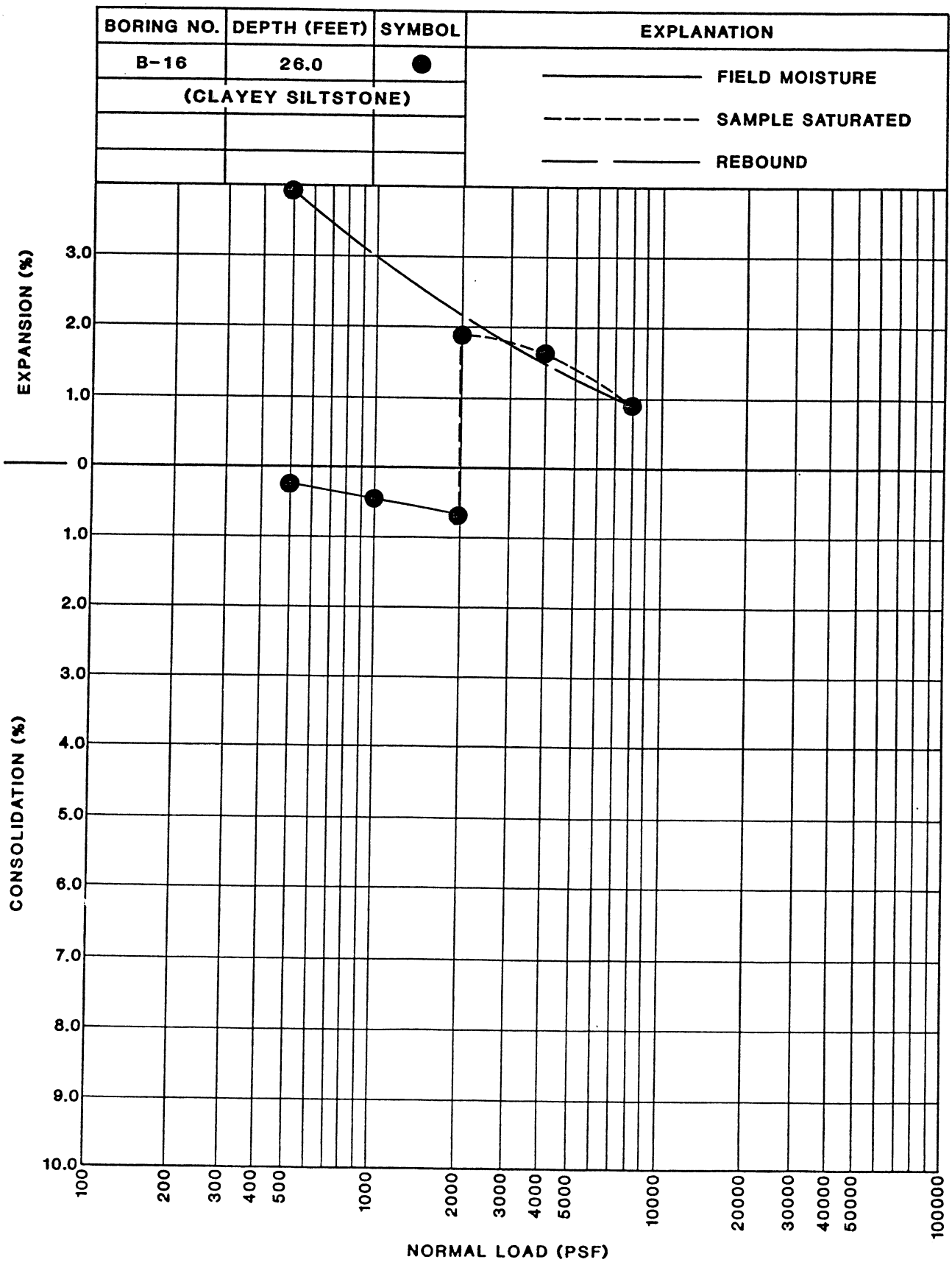
IRVINE SOILS ENGINEERING, INC.

BORING NO.	DEPTH (FEET)	SYMBOL	SOIL TYPE	EXPLANATION
B-1	20.0	●	(ML)	FIELD MOISTURE
(SANDY SILTSTONE)				SAMPLE SATURATED
				REBOUND



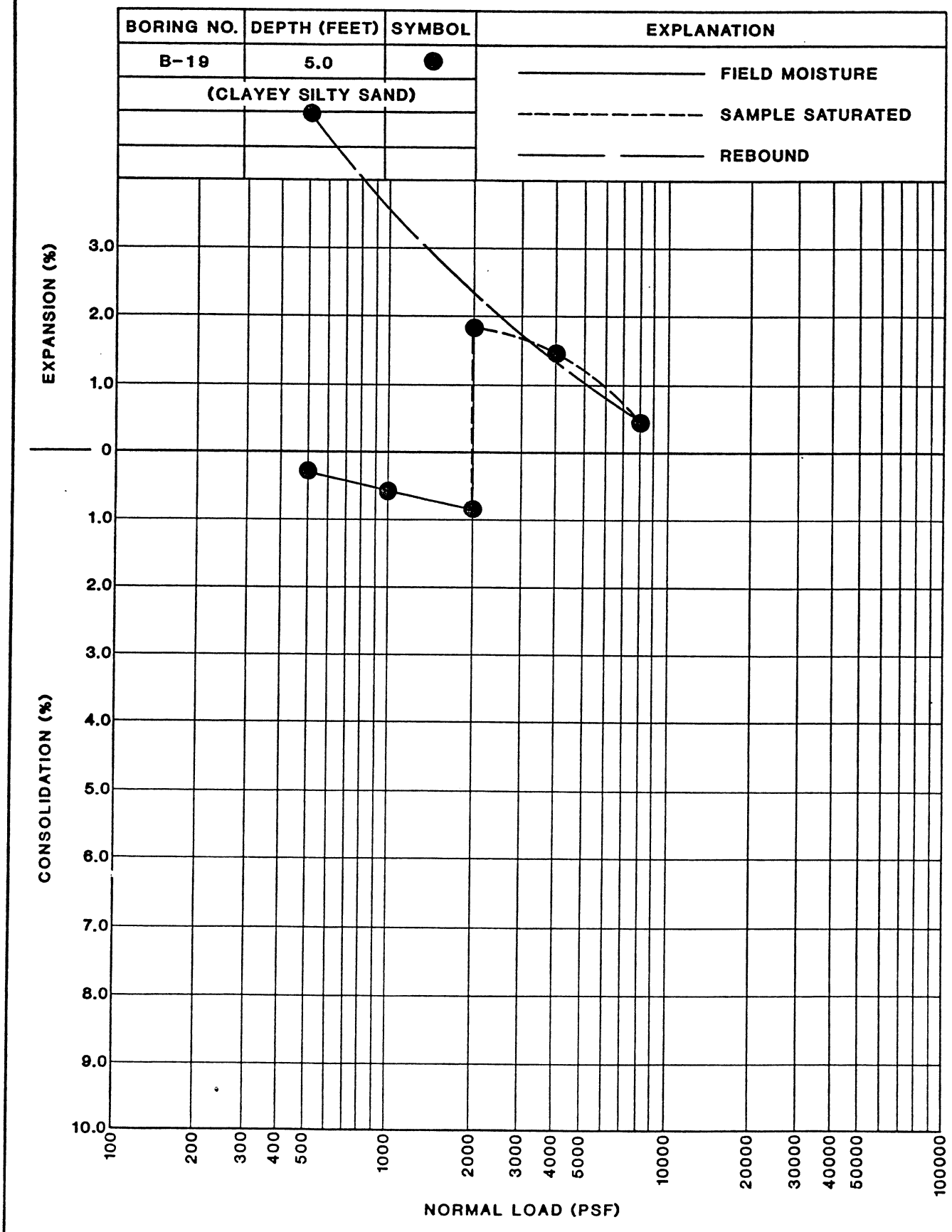
JOB NO.:	CONSOLIDATION TEST RESULTS	FIGURE:
01-6716-018-00-01		C-1.2

IRVINE SOILS ENGINEERING, INC.



JOB NO.:		FIGURE:
01-6716-018-00-01	CONSOLIDATION TEST RESULTS	C-1.3

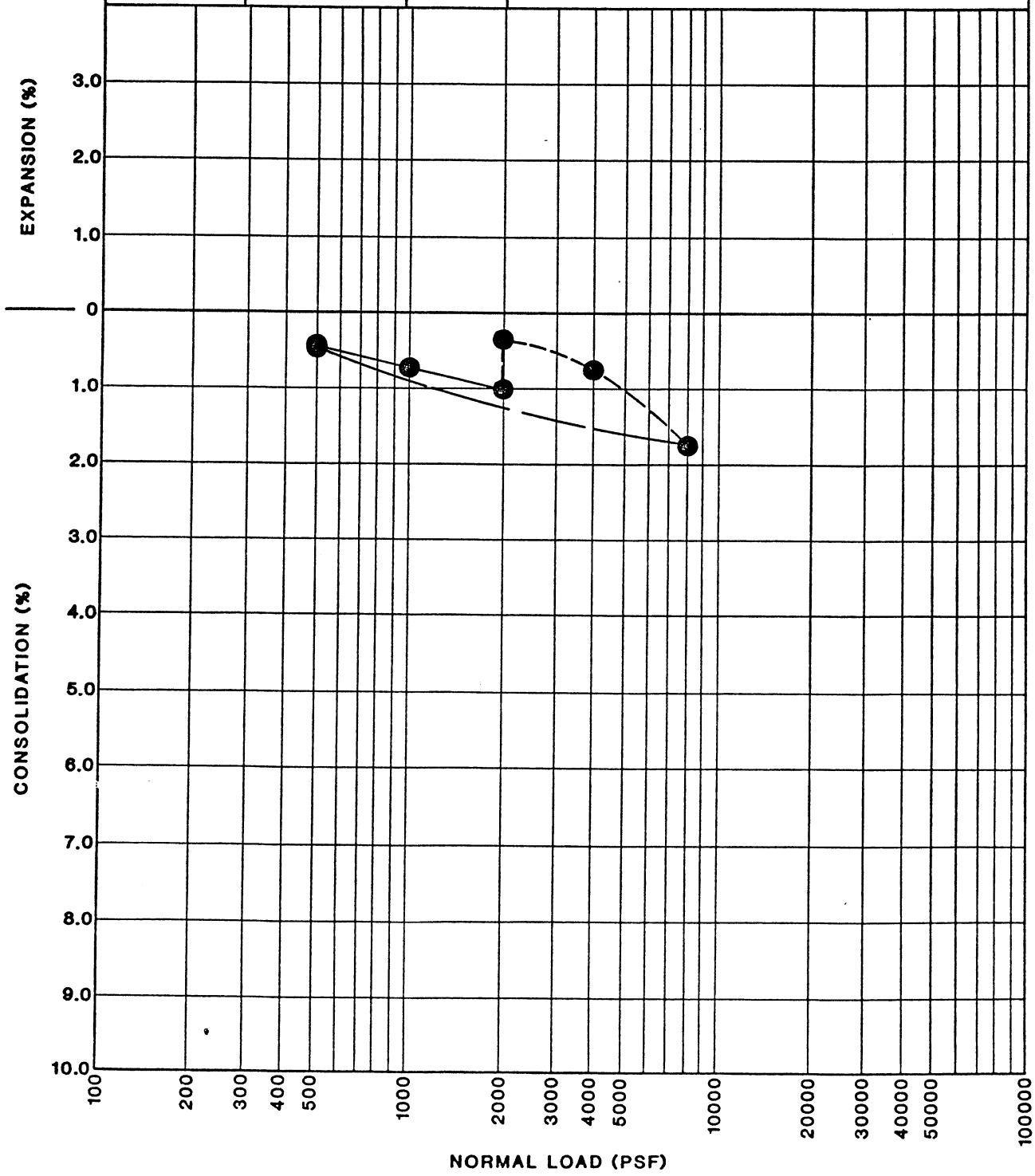
IRVINE SOILS ENGINEERING, INC.



JOB NO.:	CONSOLIDATION TEST RESULTS	FIGURE:
01-6716-018-00-01		C-1.4

IRVINE SOILS ENGINEERING, INC.

BORING NO.	DEPTH (FEET)	SYMBOL	EXPLANATION
B-20	17.0	●	FIELD MOISTURE
	(SANDY CLAY)		SAMPLE SATURATED
			REBOUND



JOB NO.:		FIGURE:
01-6716-018-00-01	CONSOLIDATION TEST RESULTS	C-1.5

IRVINE SOILS ENGINEERING, INC.

APPENDIX D

SLOPE STABILITY ANALYSIS

SLOPE STABILITY ANALYSIS

METHODOLOGY

1. a. Slope stability was analyzed using TSLOPE and TSTAB computer programs which use a limit equilibrium method for determining the Factor of Safety (FS) against sliding on an assumed failure surface.

   b. TSLOPE was utilized for the stability analyses of an assumed failure surface using the Spencer's Method for modeling the side forces.

   c. TSTAB was utilized for circular failure modes using Bishop's Simplified Method.

2. Slope stability calculations were performed on the following sections and slopes considered representative of the ranges of conditions at the site, including of critical conditions.

a. Cribwalls, Section G-G'	o Static and Pseudostatic Cases Fig. D-1.1-D-1.3 o Backcut stability construction Phase Fig. D-1.4
b. Landslide, Qls 2, Section B-B'	o Static and Pseudostatic Cases Fig. D-2.1 and D-2.3 o Backcut Stability Fig. D-2.2
c. Landslide, Qls 2, Section BB-BB'	o Static and Pseudostatic Cases Fig. D-3.1 Backcut Stability Fig. D-3.2
d. Landslide, Qls 2, Section E-E'	o Static and Pseudostatic Cases Fig. D-6.1 - D-6.3
e. Landslide, Qls 2/qls 1, CC-CC'	o Static and Pseudostatic Cases Fi~ D-4.1 o Backcut Stability Fig. D-4.2
f. Landslide, Qls 1, Section D-D"	o Static and Pseudostatic Cases Fig D-5.1 and D-5.2
g. Landslide, Qls 2, Section D-D'	o Static Case Fig. D-5.3

(Note: with respect to pseudostatic stability, analyses were generally performed for the failure surface for each particular section that had the lowest static FS; by inference, the other failure surfaces with a higher static FS will have a higher pseudostatic FS than those that were analyzed).

3. Based on the laboratory test results from this and previous investigations, the following reasonably conservative soil parameters were used in our analyses and evaluations. Shear tests were performed on saturated samples and were sheared while soaked, to model possible adverse field conditions. Shear parameters are based on residual strengths for the static conditions. These are taken between the average residual and average peak for the pseudostatic and temporary (during construction or grading) conditions.

TABLE D-1
Soil Parameters For Analysis

Material	Sat. Bulk Density (lb/ft^3)	Shear Strengths			
		Static		Pseudostatic/Temp.	
		Ø (°)	c(lb/ft^2)	Ø (°)	c(lb/ft^2)
Silty Sandstone	134	33	100	35	200
Landslide Rupture Surface	134	10	300	13	400
Siltstone					
o Across Bedding	134	24	250	26	300
o Along Bedding	134	20	250	22	300
Engineered Fill	132	27	200	29	300

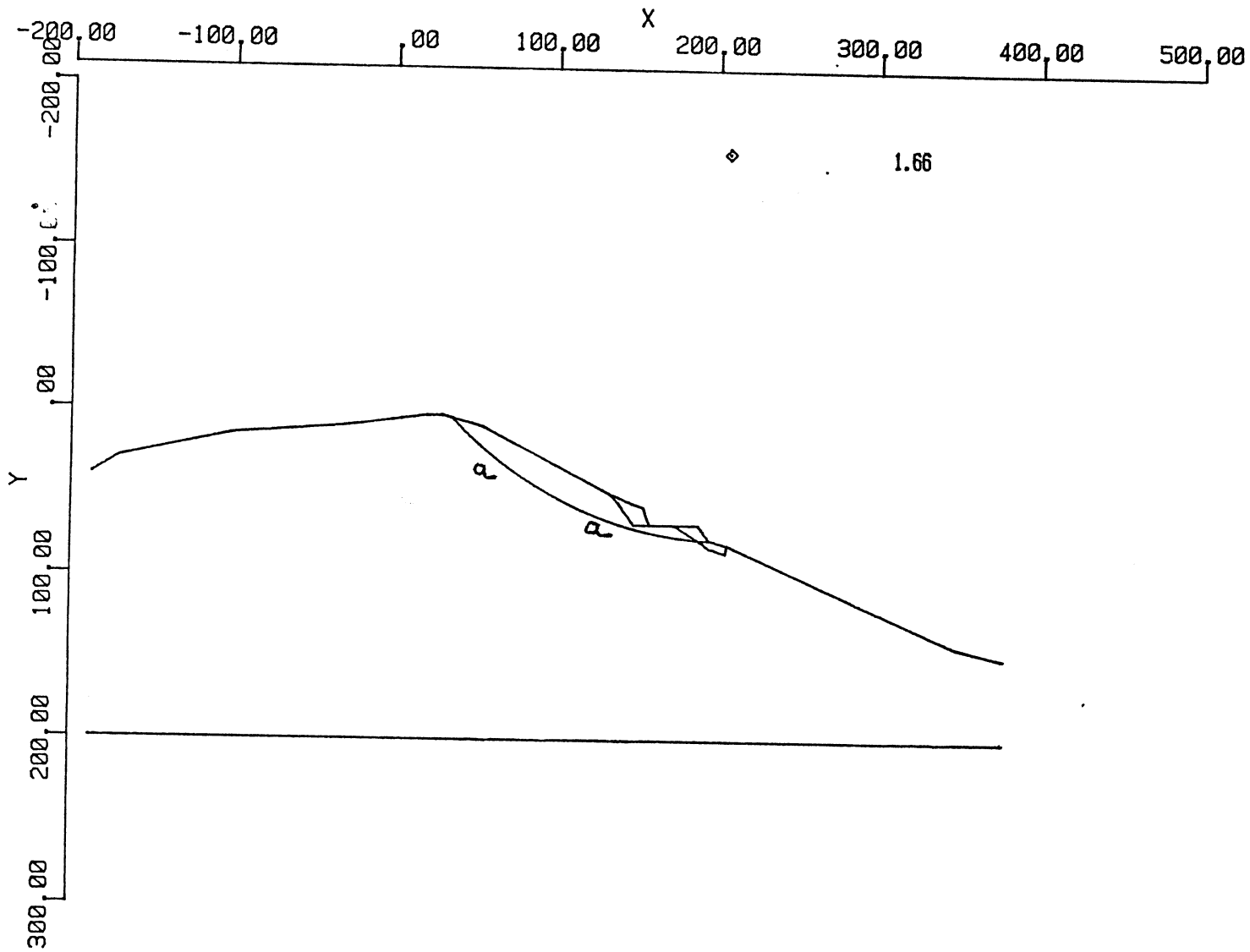
4. The Factor of Safety for the completed slopes were found to equal or exceed 1.5 and 1.1 for the static and pseudostatic cases, respectively.

5. The Factors of Safety for the completed retained slopes were found to equal or exceed 1.5 and 1.1 for the static and pseudostatic cases respectively, for a wall with footing embedment of at least 5 feet.

6. The Factor of Safety for the natural slopes within Landslides Qls1 and Qls 2 were found to be equal or exceed 1.5 and 1.1 for the static and pseudostatic cases, respectively.

7. The Factor of Safety for the construction excavations was found to equal or exceed 1.26 for the back cuts shown on the Cross Section.

8. Should conditions substantially different from those described in this report be encountered during grading our office should be notified immediately so that the analyses may be reviewed.



CDC, 01-6716-018-00-01 , SECT. G-G' , SEC
RESULTS

TRIAL SURFACE BELOW UPPER CRIBWALL-SECT. G-G', SECTOR a-a, STATIC

JOB NO.:	DATE:	FIGURE:
01-6716-018-00-01	JULY 1989	D-1.1.1.1

IRVINE SOILS ENGINEERING INC